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The Corbit-Sharp House at Odessa, Delaware: Finishes Analysis and Interpretation of Four Interior Rooms

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THE CORBIT-SHARP HOUSE AT ODESSA, DELAWARE:
FINISHES ANALYSIS AND INTERPRETATION OF FOUR INTERIOR ROOMS

Catherine Ruth Matsen

A THESIS

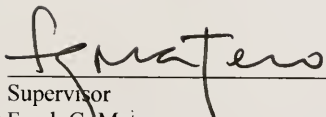
in

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in
Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

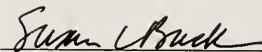
2003



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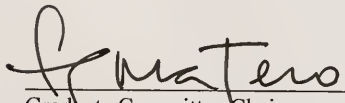
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ACKNOWLEDGEMENTS

I would like to express my appreciation to several individuals who contributed considerable attention, knowledge and time to the completion of this thesis.

First and foremost, Dr. Susan L. Buck deserves tremendous recognition for her contribution to this work. Her knowledge and enthusiasm for the study of historic finishes inspired me to focus on this area of historic preservation. She has provided continual guidance with my analysis and research and has been especially generous with her time, resources and knowledge.

I owe special gratitude and credit to Janice Carlson, Dr. Jennifer Mass and Dr. Chris Petersen at the Scientific Research and Analysis Laboratory, Winterthur Museum for their expertise and help. I am especially grateful to Jan for introducing me to the field of conservation science and for granting permission to use the equipment in the lab.

I would like to thank the entire staff of the Historic Houses of Odessa for repeated access to the Corbit-Sharp House, especially to curator Steve Pulinka for discussions about the property he knows so thoroughly.

At the University of Pennsylvania I would like to thank my advisor, Frank G. Matero, Rynta Fourie, and my classmates.

Thank you to my parents, grandparents and entire family for their interest and support.

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INTRODUCTION

This research addresses the examination and analysis of the original interior finishes of four rooms of the Corbit-Sharp House (1774) located in Odessa, Delaware. Interpretation of the findings will help to define the eighteenth-century treatments as they relate to the functions and significance of the rooms and the deliberate choices made by builder William Corbit (1746-1818) regarding the decor of his country mansion. Although this study is site-specific, the findings should provide additional knowledge of interior paint practices of eighteenth-century architecture in the mid-Atlantic region. Secondly, this analysis provides the opportunity for paint evidence to distinguish between original and added elements and to help determine when alterations took place.

A finishes study of the Corbit-Sharp House is warranted due to the building's architectural and historical significance. The two previous paint analyses of the Corbit-Sharp House were performed circa 1940-1950s and in the late 1970s; advances in paint analysis methodologies since then take advantage of higher-powered microscopes, fluorescent microscopy, and biological stains to more accurately evaluate paint stratigraphies in cross-section. Current microscopic and chemical analysis techniques allow identification of the composition of original paint sequences – including the pigments, binders, additives, glazes, and varnishes of these layers.

The finishes study will be limited to four rooms of the house: the parlor; the first-floor, northwest chamber; the drawing room; and the second-floor, southeast chamber. The choice of these rooms will allow comparison of two public and two private rooms within the house; the parlor and the drawing room being public spaces and the other two rooms thought to be private chambers.

For the parlor, in addition to understanding the original paint color of the woodwork, it is of interest to determine whether the white plastered walls were originally papered. Recent research into Georgian house interiors suggests there are distinct relationships between the paint colors applied to woodwork and the treatment of plaster walls. Pale paint colors on simply carved woodwork were most frequently combined with wallpaper during the second half of the eighteenth century. Conversely, rooms with strong and vivid paint colors on the trim were often not accompanied with wallpaper. Sampling of both the wood trim and areas of original plaster in this room will help to appropriately interpret its original decorations. The findings will also address an important question regarding eighteenth-century home interiors: to understand how residents chose to demonstrate their wealth – whether through the display of textiles, valuable furnishings, wallpaper, or the application of expensive paints.

The 1818 inventory of the house clearly shows that the room behind the parlor was used as a bed chamber. However, the room use may have differed from its original function four decades prior, when the house was first constructed. Comparison of the original finishes in the first-floor chamber and second-floor, southeast chamber (with direct access to the drawing room) may determine a hierarchy between the two spaces. The significance distinction of the two spaces may be reflected in the choice of finishes, decorative form of the woodwork, and furnishings within.

The fourth, and most important, room to be analyzed is the second-floor drawing room. This large room is the most elaborate in the house: its woodwork includes fluted pilasters which support an entablature and modillioned cornice extending around the room; an overmantel frame surmounted by a broken pediment; and a fret-carved base molding and surbase applied to the wainscoting. Establishment of the original paint colors of this

highly decorated space is essential to its interpretation.

A wide range of analytical techniques was used to obtain information about the original finishes: cross-section microscopy with reflected visible and ultraviolet light combined with the use of fluorescent stains; polarized light microscopy (PLM); Fourier transform infrared (FTIR) microspectroscopy; gas chromatography-mass spectrometry (GC-MS); scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS); and color matching with a colorimeter. The results of these analytical methods form an almost complete picture of the original appearances of the four rooms and the materials used to create the painted decorations while the choice of the decorative architectural finishes are informative of William Corbit's personal aesthetic and represent decisions with social and cultural foundations.

CHAPTER I

HISTORICAL CONTEXT

The Corbit-Sharp House (1774) is a valuable example of American-Georgian architecture, recognized for its “fine woodwork and related in form and plan to important Philadelphia houses of the period”. The Corbit-Sharp House is also significant in the history of Delaware as it reflects the prosperity of the commercial town that grew up around the junction of the Appoquinimink Creek and the King’s Highway. Furthermore, the house stands as a testament to its commissioner, William Corbit (1746-1818).¹

William Corbit was born in Chester County, Pennsylvania but spent his formative years in the rural town of Cantwell’s Bridge, situated along the banks of the Appoquinimink Creek in Delaware. His Quaker ancestors migrated from England to the Delaware region in the 1670s and obtained significant land holdings in this area. William’s father was an enterprising wheat farmer in Cantwell’s Bridge, but as the youngest of three boys William had to forego inheritance of the family farms and business. Instead, William pursued training in a craft; accordingly, in 1765, at the age of nineteen, he went to Philadelphia to learn the tanning trade under the direction of his cousin.

After a two year apprenticeship in Philadelphia, William returned to Cantwell’s Bridge and started his own tannery on the banks of the Appoquinimink Creek.² This part of New Castle County was economically and socially connected with Philadelphia by means of the Appoquinimink Creek and the Delaware River. Cantwell’s Bridge was

¹ John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), ix.

² It is possible that Corbit “had some training in a trade before he went to Philadelphia, for the length of time he spent there was considerably less than the normal apprenticeship of seven years.” John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), 17.

an advantageous location for the tannery, situated between the cattle-rich Delaware countryside and the expanding Philadelphia metropolis. In addition, Corbit had an advantage over Philadelphia tanners because of Delaware's abundance of Spanish-oak bark – an essential ingredient in the tanning process from the tree native to southern New Castle County.

Consequently, the tannery became a remarkably prosperous operation and produced financial success for Corbit. By the early 1770s William was able to fund the construction of a new house as a monument to his business accomplishments and rising social status. However, he was by no means a “country aristocrat”; his wealth was dependent on the success of his business, not the quiet existence of an inherited estate.³ Corbit chose to build his house near the site of his tannery to be close to his business. The house also served a practical function in connection with the tannery as Corbit's business relations would often require lodging with trips to the town.⁴

In the immediate decades prior to the American Revolution, a transformation in American residential architecture placed emphasis on luxury and style which came to have significant social implications.⁵ Therefore, Corbit faced decisions regarding the design and level of sophistication of his house. His experience in Philadelphia made him aware of elegant, urbane Georgian architecture, and thus he strived to simulate the sophistication of a town house in his mansion in a small, rural town. The designer of Corbit's house is unknown yet the evidence indicates that he was keenly aware of architectural design books from England, specifically Abraham Swan's *Designs in*

³ James E. McWilliams, “The Corbit House in Odessa, Delaware,” *Early American Life* (December 2002), 39.

⁴ *Corbit-Sharp House Interpretation: Room by Room Themes*. June 17, 1994.

⁵ James E. McWilliams, “The Corbit House in Odessa, Delaware,” *Early American Life* (December 2002), 39.

Architecture (London, 1757). The builder of the house was Robert May and Company though it is uncertain who Robert May was – whether he was a carpenter, architect, or builder. His presence in New Castle County, Delaware during the second half of the eighteenth century is well established and therefore makes it possible to describe the Corbit house as a native production rather than a British importation.⁶

Work on the house began in the spring or early summer of 1772. Corbit paid close attention to his expenditures which he meticulously documented in a building account.⁷ Initially his spending was financially cautious, focusing on the essentials rather than luxuries. But in February 1773, during the construction of the house, William Corbit married Mary Pennell, the daughter of a Wilmington merchant.⁸ The £700 dowry of Mary Pennell undoubtedly contributed to financing the construction of Corbit's house. After his marriage, work proceeded more rapidly and with added emphasis on elegance.

On August 10, 1774, Robert May and Company presented the final bill of carpentry work to William Corbit. The majestic house stands at two and a half stories with a five-bay façade. The front elevation is of red brick laid in Flemish bond with molded water table, and granite belt course and window lintels. The pedimented doorway, with an eight-paneled door and arched, Gothic-style transom, is flanked by two Tuscan pilasters. White paneled shutters frame the windows of the lower story, while those of the second story have louvered blinds. A bold cornice with carved mutule blocks and decorated soffit accents the façade and the two dormer windows have tops with pointed Gothic lights and

⁶ John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), 69.

⁷ See Appendix A "William Corbit's Building Accounts" from *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware*; transcript of the manuscript in the Historical Society of Delaware, Corbit-Higgins-Spruance Papers.

⁸ Mary Pennell was William Corbit's second wife. His first wife was Elizabeth Empson whom he married shortly after his return to Cantwell's Bridge. Elizabeth Empson died circa 1770; the couple did not have children. Ibid, 20, 125.

decorative consoles. The hip roof is surmounted by a “Chineas Lattis” balustrade set between two massive chimney stacks (Figure A-1).

The interior plan consists of a center hall with four rooms on the ground floor. On one side is the parlor and a chamber; on the other, the dining room and, up a short flight of stairs, Corbit’s office. Originally, cooking was done in the basement beneath the office; in 1790, a kitchen wing was added on the south side of the house with direct access to the dining room. On the second floor are three chambers, and across the front of the house is a drawing room formed by including the width of the hallway and the area allotted for the northeast room (Figures B-1 and B-2). William Corbit built a beautiful house of the best materials and in the latest style. The character of the house was in keeping with eighteenth-century Quaker virtues of simplicity and “elegant neatness.”⁹ During his lifetime, Corbit became a successful businessman, acquired significant wealth, and was a leader in the community.

After Mary Pennell’s death in 1783, William Corbit married two more times. With his marriages he had thirteen children, eight of whom lived to adulthood. His fourth and last wife, Mary Cowgill (1761-1845), survived her husband by twenty-seven years, living in the mansion until her death. Daniel Corbit, the son of William Corbit and Mary Cowgill Corbit, was the next in line to inherit the house. At the time of Daniel’s death in 1877, the house was passed to his son, Daniel Wheeler Corbit. Daniel Wheeler Corbit made certain changes to the house to suit the changing tastes of the late nineteenth century. With the death of Daniel Wheeler Corbit in 1922, the male line of the family ended. From 1922 to 1938 the house was a tenant property rented to a local farmer(s). In 1938 the house was sold to Delaware philanthropist H. Rodney Sharp. Under Sharp’s

⁹ John A. H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), 70.

direction, from 1938 to 1942, H.L. Lindsey, a local contractor, meticulously restored the house to its eighteenth-century appearance. Lindsey wrote a comprehensive account which justified each restoration act as his work was easily guided by the original 1774 carpenter's bill of Robert May and Company.¹⁰ In 1958, H. Rodney Sharp donated the property to Winterthur Museum.

In the years preceding the American Revolution, William Corbit succeeded in building the most distinguished house in rural Delaware. The documents that survive regarding the construction of the house – Corbit's own building account and the carpenter's bill – reveal a great deal about both Corbit the man and the era in which he lived. The work of this paint analysis will reveal additional information regarding the deliberate choices made by William Corbit regarding the original interior finish treatments of his mansion as well as provide useful information on further interpretation.

¹⁰ Marty Hackett, "H.L. Lindsey's Final Restoration of the William Corbit Mansion" (May 1997).

CHAPTER 2

EIGHTEENTH-CENTURY ARCHITECTURAL PAINTS: MATERIALS AND APPLICATION

William Corbit's detailed account books provide important information about materials purchased, the amount of time required for certain tasks, the relative importance of specific building activities (based on costs), and some limited information about the craftspeople employed by Corbit. The building account mentions few workmen by name, yet the document does indicate that Joseph Stride did the painting. The first entry in Corbit's account pertaining to paint materials dates to May 12, 1773 and states:

To 120 Qts of White lead at 9½ ^d 8 gallons oyl	
¾ hundred Whiting & other paints as p ^r Bill	£ 8 14s 4d

The following entries, dated June 10 and June 30, 1773, list:

To Lead Whiting &c As p ^r Bill	£ 2 0s 0d
To Cash paid [...] glasing & painting	£10 3s 0d

The dates of these entries, during the first stages of construction, and the materials listed suggest the exterior trim, painted as it was completed, was originally white. Entries in 1774 list:

To Oyl & Whitelead & paints p ^r Stride	£13 9s 0d
To part of [...] nside p ^r Stride	£ 6 0s 6d

The total cost for painting the house, including materials and Stride's labor and board, amounted to more than £45 and indicates that the painted walls would have been a luxury in colonial times.¹¹ In order to properly characterize the composition of the first-generation paints of the Corbit House, it is important to have knowledge of the available paint materials and the techniques practiced in the eighteenth century.

¹¹ John A. H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), 45.

At the beginning of the eighteenth century, skilled craftsmen from England were brought to the colony to undertake the sophisticated painting projects of buildings. By the mid-eighteenth century, however, the paint profession came to include artisans born in the colony who were trained in the preparation and application of oil paints. The colonial painting tradition thus emerged directly from British practice, and throughout the century most paint materials were imported from Britain.¹²

Three general finish mediums were employed in the painters' trade at the time of construction of the Corbit House: water-based paints; oil-based-paints; and varnishes. The most common finish for plaster walls and ceilings were distempers, made from a combination of water-soaked whiting mixed with color and bound with animal skin glue.¹³ Film formation of distemper paints occurs by solvent loss; the water evaporates and the size (a weak solution of animal hide glue) consolidates the pigments to leave behind a solid film. Although examples of water-based paints applied to wood substrates do exist, such finishes were generally reserved for plasterwork. Distempers of this type were considered relatively inexpensive and fragile coatings (due to their water solubility). They were paints applied by masons or plasterers and were considered a temporary finish that was usually washed off and renewed every few years. Distempers also acted as a temporary decorative surface while the plaster fully cured, after which oil-based paints could be applied, if cost allowed.

Another traditional water-based treatment for newly plastered walls was whitewash, used for the same purposes as distempers paints. Whitewashes were applied not by painters but rather by masons or plasterers with or without pigments added, and were applied to

¹² Susan Buck and Willie Graham, "Architectural Paints in the Chesapeake," manuscript in progress for *The Chesapeake House*, ed. Carl R. Lounsbury, 17.

¹³ Christopher Ohrstrom, "Some Notes on Distempers, Calcimine and Casein Paints," *Traditional Paint News* 1, No. 2 (October 1996): 24.

plaster walls as a temporary finish before they had completely cured. The whitewash remained exposed for about two years until the plaster set, after which the desired finish, perhaps oil paint or wallpaper, was applied. Whitewash, also called limewash, differs from distemper paints in that they do not contain a size medium. Instead, whitewash forms a solid paint film through crystal formation and as such is inorganically bound paints.¹⁴ For the process of whitewashing, quicklime was hydrated by the mason or plasterer upon mixing with water and applied to the walls in the form of hydrated lime (also known as slaked lime). The slaked lime then undergoes carbonation upon exposure to carbon dioxide in the air to form lime white.¹⁵

Where more durable and water repellent architectural coatings were needed, oil-based paints were employed. Drying oils have the ability to form a solid, elastic film by cross-polymerization. In this process, drying oils are oxidized when exposed to air; the oxidation products then react and combine with one another to form a cross-linked, high molecular weight polymer film. The most commonly used are vegetable drying oils derived from seeds such as flax (linseed oil) and from nuts such as walnut. The use of metallic compounds, known as ‘driers’, accelerate the rate of polymerization of oil films. For example, in the eighteenth century, lead-, manganese- and cobalt-based compounds were dispersed in oil and mixed with the paint; these materials often functioned as both driers as well as pigment to impart color. Another way to produce a fast-drying oil was to heat the raw oil with metal driers, in which case the product was called ‘boiled

¹⁴ Morgan W. Phillips, “A Survey of Paint Technology,” *Paint in America: The Colors of Historic Buildings*. Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 232. This definition differs from that given by another source in which whitewash and distemper were “employed to distinguish paints containing size”; Ian Bristow *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 111.

¹⁵ The process is shown by the series of chemical reactions:
hydration: $\text{CaO (quicklime)} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 \text{ (slaked lime)}$
carbonation: $\text{Ca(OH)}_2 \text{ (slaked lime)} + \text{CO}_2 \rightarrow \text{CaCO}_3 \text{ (lime)} + \text{H}_2\text{O}$

oil'. However, this process had the disadvantage for use in interior woodwork in that it produced darker oils with the tendency to yellow over time. In general, oil paints were composed by use of a white-pigmented base which was tinted with the necessary pigments to the desired color. Lead white in linseed oil was the most common base formulation which produced durable opaque finishes.

Varnishes are transparent finishes composed chiefly of tree and insect resins. They are made by dissolving one or more natural resins – such as shellac, dammar and mastic – in alcohol or turpentine. Hard resins such as copal are heated and then dissolved in linseed oil for use as varnishes. Varnishes were used on architectural elements as a transparent, glossy finish for unpainted woodwork, oil paints, and distempers; they also functioned as a binder for opaque paints and as tinted, transparent lacquers.

Pigments are used in paints to impart color and hiding power; they are suspended as discrete particles in the medium or vehicle in which they are used. Pigments are often broadly classified as either organic or inorganic materials; they are obtained from a wide variety of naturally occurring mineral, animal and vegetable sources and may also be synthetically manufactured. While understood to be essential information for the technical analysis of paints, the subject of pigments is a vast topic too great to be adequately discussed for the present purposes. The reader is referred Ian Bristow's *Interior House-Painting Colours and Technology 1615-1840* which provides a thorough description of architectural pigments and colorants used in the eighteenth century in England and Theodore Z. Penn's master's thesis "Decorative and Protective Finishes, 1750-1850: Materials, Process, and Craft" for reference to American painting practices.¹⁶ Instead, this discussion will focus on eighteenth-century methods of preparation and

¹⁶ One may also consult the source *Painting Materials: A Short Encyclopedia* by Gettens and Stout to understand the composition and properties of pigments.

application of interior architectural paints.

With regard to painting technique, surface preparation was just as important as the final presentation layer. The knotting process was intended to prevent resin present in the knots of the timber from seeping through the paint film and thereby producing a stain. Formulations for knotting, typically applied locally to the knots, varied but included combinations of litharge, white lead and red lead in oil. In contrast with the oil-based formulae, aqueous preparations were used which contained a drier (the same as were used for oil-based) bound in size.¹⁷ In addition, some recipe books directed the application of two knotting layers combining size and oil. Stopping was required in areas of woodwork with visible cracks in order to prevent the entry of water. Cracks were filled with a putty material typically a mixture of whiting in oil with the consistency of “stiff dough”.¹⁸

The first coat of paint applied to wood substrates, known as the primer layer, was most commonly oil-based and contained a higher proportion of filler pigments such as whiting, gypsum and sand (quartz). Primers served as a sealant so less of the more expensive pigmented paint would be required for a consistent, opaque coating. When interiors were to be painted three times in oil, the primer coat would usually contain a higher proportion of drier than in subsequent coats.¹⁹ The driers used for primers in the eighteenth century were generally based on lead white, litharge, red lead, or combinations of these materials. On plaster surfaces one or more coats of pure oil might be applied as a primer.²⁰ Size bound primers were also used for interior woodwork and plaster walls. In Pinot’s

¹⁷ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 104.

¹⁸ *Ibid*

¹⁹ Richard M. Candee, “Housepaints in Colonial America: Their Materials, Manufacture and Application” *Color Engineering* (New York: Chromatic Publishing Company, 1967), 8.

²⁰ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 98.

Treatise on the Practical Part of Coach & House Painting, it is suggested that:

‘In new houses the inside work may be Primed with strong double Size, just stained with a little Spanish Brown, merely to see where the brush has been.’²¹

Another recipe book explains for the preparation of a size-bound primer to:

‘...dissolve one pound of Glue in one gallon of boiling water; add two pounds of Spanish White; and when cold, and well mixed; lay it on carefully; and even with the grain of the wood, with a clean brush.’²²

The use of whiting (Spanish white) added to the size is effectively distemper paint. Such a mixture was known during the period as clearcole and was considered an inexpensive primer. A coat of whiting and size covered with a single coat of oil paint, known in England as “clear coal and finish” or “half-price work”, may have been equally common in America as the cheapest method of interior painting. The price per yard of work “clear coaled and finish’d” listed in a London estimator’s guide was exactly one half the cost of painting with three coats of oil paints.²³ Recipe books also specified the use of lead white-based clearcole in place of whiting in the upper layers of distemper, probably with the intention of producing a cleaner, more opaque color.²⁴

Pigments were sold either dry or ‘ground in oil’ (a paste form) and were further ground or mixed with oil by trained painters with stone mills, a ball and trough, or a slab-and-muller.²⁵ The slab was a heavy piece of marble or granite, approximately a foot and a half square and the muller was a large egg-shaped stone with one end broken, ground flat

²¹ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 100.

²² *Ibid.*

²³ Richard M. Candee, “Housepaints in Colonial America: Their Materials, Manufacture and Application” *Color Engineering* (New York: Chromatic Publishing Company, 1967), 7.

²⁴ Ian Bristow, “House Painting in Britain: Sources for American Paints, 1615 to 1830,” *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 44.

²⁵ Richard M. Candee, “Housepaints in Colonial America: Their Materials, Manufacture and Application” *Color Engineering* (New York: Chromatic Publishing Company, 1967), 3.

and rounded off around the edge to let the paint move easily. Instructions for grinding pigments in oil state:

“...take a small quantity of the color you intend to grind (two spoonfuls is enough) for the less you grind at a time, the easier and finer will your Colour be ground: lay this two Spoonfuls of the Colour on the middest of your stone, and put a little Linseed Oyl to it, (but be sure you put not too much at first) then with your Mulier, mix it together a little, and turn your Mulier five or six times about, and if you find there be not Oyl enough, put a little more to it, and grind it till it comes to the consistence of an Oyntment...and when you find you have ground it fine enough, by the continual Motion of your Mulier about the Stone, holding it down by hand as your Strength will permit (which you must also move with such a slight, as to gather the Colour under it)...cleanse it off the Stone into a Gallery Pot, Pan, or whatever else you design to put it into, and then lay more Colour on your Stone and proceed to grind as before...”²⁶

The hand process was obviously a laborious process; hence, by the 1740s, ‘Horse-Mills’ to grind pigments in oil were developed in England as a more economic alternative. The extent of use of these mills in the colony is not known. Advances in paint mills were recognized in America by the turn of the nineteenth century and commercial scale machine mills were patented in the mid-eighteen hundreds.²⁷

The minimum number of coats generally recommended for new work was three, representing (in modern terms) priming, undercoat, and finish. When an oil primer was used the treatment was known as “three times in oil,” but where the work was primed in size it was referred to as “twice in oil and primed in size.”²⁸ The use of oil-based paints indicates surfaces with this treatment had a highly glossy appearance. In

²⁶ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 90-1. From John Smith, *The Art of Painting in Oyl* (London, 1723), 33-34.

²⁷ Teresa Green, “The Birth of the American Paint Industry.” M.A. thesis, University of Delaware (1965), 105.

²⁸ Ian Bristow House, “Painting in Britain: Sources for American Paints, 1615 to 1830,” *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 49.

addition, the application of resin or oil varnishes to paints would give an even more lustrous appearance. If a matte appearance of the final finish coat was desired, a high proportion of turpentine relative to the amount of oil was used. Or, the effect was achieved by using a final coat of white lead and turpentine without oil.²⁹ Flat finishes became highly desirable from the 1740s onward; this is known to be a British practice but not much evidence has been found for flat finishes in the Colonies or after the American Revolution. Such a treatment was relatively more expensive and resulted in a fragile surface.³⁰

In addition to the binding media, colorants and solvents used in paint mixtures, extenders were added in order to diffuse or dilute the paint film. Chalk (whiting) and sand were two common extenders used for their inert, colorless or white and effectively transparent properties. The use of such materials cheapened the paints to which they were added and therefore they are also referred to as adulterants.

As previously explained, house-paints were generally made starting from a base of opaque white. The necessary tinting pigments were added to this base paint to achieve the desired color, yet such formulations were rarely quantified; colors were described with names such as ‘cream colour’, ‘stone colour’, ‘chocolate colour’, ‘pea colour’, ‘pink colour’, etc. In John Smith’s 1723 *The Art of Painting in Oyl*, paint recipes for colors are listed in terms of the major pigments; a ‘stone colour, for example, is described as being made from spruce ochre and white, whereas a ‘brown colour’ is made from raw or burnt umber with no lead white.³¹ The cost of pigments undoubtedly influenced the home

²⁹ Richard M. Candee, “Housepaints in Colonial America: Their Materials, Manufacture and Application” *Color Engineering* (New York: Chromatic Publishing Company, 1967), 8.

³⁰ Patrick Baty, “Some Myths Laid to Rest,” *Traditional Paint News* 1, No. 2 (October 1996), 42.

³¹ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 143.

owner's choice of paint colors. In the eighteenth century, expensive paints had the ability to imply wealth and status whereas colors made with cheaper materials were used for obvious economic reasons, especially considering the extensive amount of paint needed for the large surface areas of architecture.

In contrast to the quite opaque oil paints typically produced with lead white, semi-translucent glazes were a popular finish in the eighteenth century. Such surfaces had a more intense depth of color, were highly glossy and durable. A popular pigment employed for glazing in the eighteenth century was the green, copper-based pigment verdigris. The glaze was in the form of a copper resinate, produced by dissolving verdigris in oil and resin (usually pine resin) by the use of heat. Copper resinate glazes were considered a costly finish not only due to the expense of verdigris but also because the preparation and application of the copper resinate would have required the skill of an experienced painter. Copper resinate glazes were always applied over an opaque base coat, often blue-gray in color, and with multiple coats, since the glaze itself was translucent.³² Upon prolonged exposure to the atmosphere, verdigris degrades to black cupric oxide; copper resinates also discolor to brown. Verdigris was imported to Philadelphia as early as 1747 under the names French and English verdigris.³³

A considerable part of the house-painter's skill lay in the imitation of fine woods and marble. The use of imitation finishes in the eighteenth century was a fashionable and impressive addition to a room's decor. More importantly, it was a conscious display of wealth since, in most instances, the cost to apply such finishes would be more than

³² Frank Welsh, "The Early American Palette: Colonial Paint Colors Revealed," *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 75.

³³ Richard M. Candee, "Housepaints in Colonial America: Their Materials, Manufacture and Application" *Color Engineering* (New York: Chromatic Publishing Company, 1967), 13. From *The Pennsylvania Gazette*, Philadelphia, June 25, 1747, p.3, col.3.

the cost of the actual material it was to imitate. Imitation finishes were composed of a sequence of multiple paint layers. Graining, for example, consisted of a base coat, typically an oil paint, that provided the background color of the wood it was to imitate. Next, a series of layers of transparent pigmented glazes were applied in which the wood graining was emulated. These paints were usually water-based distempers; this gave the painter the freedom to easily rework the appearance of these layers with a damp rag. Once the final appearance of the imitation was attained, a protective, resinous varnish layer was applied.

Eighteenth-century house-painting was a prolonged and costly process. For the Corbit House, the raw paint materials were likely purchased in Philadelphia and brought to Cantwell's Bridge. On site Joseph Stride would have prepared the newly joined woodwork, hand ground the paints (with or without the help of an assistant), and applied them accordingly in the rooms. The brushes used to apply paint were round, with the exception of flat brushes used for drawing lines and for imitation graining and marbling. They were made from hog's hair, and varied in diameter from one-fourth to two inches.³⁴ A good paint job was measured by "the fullness and solidity of its appearance without any marks of the brush" and should be careful not to "leave any hair marks on the work."³⁵

In most work, the prime coat was laid and allowed to dry completely before the subsequent finish coats were applied. Depending on the driers added to the oil, it could be several days between paint applications. Each coat of paint would be rubbed down

³⁴ Ian Bristow, *Interior House-Painting Colours and Technology 1615-1840* (New Haven: Yale University Press, 1996), 105.

³⁵ Patrick Baty, "Some Myths Laid to Rest," *Traditional Paint News* 1, No.2 (October 1996), 40. From Thomas Martin, *The Circle of the Mechanical Arts* (1813) and T.H. Vanherman, *Every Man his own House-Painter* (1829).

with glass-paper and dusted before the next application of paint.³⁶ The lengthy process of painting a house large and grand as the Corbit mansion necessitated lodging for Joseph Stride, as evidenced by Corbit's building account. Among the last set of entries in the building account, dated December 1775, is the record:

To Cash paid Jo^s Stride for painting £13 1s 7d

Thus, interior painting was likely part the final work completed and would have greatly contributed to the furnishings and overall interior decoration of the country mansion. The building account specifically mentions the purchase of white lead, whiting and oil; yet the composition of the finishes undoubtedly included more materials than just these three listed by Corbit. A full technical analysis will therefore supplement the documentation and identify additional ingredients of the eighteenth-century finishes.

³⁶ Glass-paper is an abrasive paper coated with pulverized glass.

CHAPTER 3

SUMMARY OF PREVIOUS PAINT STUDIES OF THE CORBIT-SHARP HOUSE

Limited documentation exists of earlier paint studies of the Corbit-Sharp House; therefore, it is difficult to reconstruct exactly what investigations were performed and their findings. Of the four rooms analyzed for this thesis – the parlor, first-floor northwest chamber, drawing room, and second-floor southeast chamber – there have been two previous campaigns to discover the original paint colors. The work of this thesis represents the third such endeavor.

The first attempt of a finishes analysis of the Corbit-Sharp House was purportedly carried out “in about 1939” during the restoration plan of owner H. Rodney Sharp, as Sharp wanted to restore the house to its eighteenth-century appearance.³⁷ However, in H.L. Lindsey’s restoration account, written circa 1942, there is no mention of scrape tests. In fact, sentences of the individual room accounts that begin ‘The color of the original paint was...’ end mid-sentence with a blank space left by Lindsey. This suggests that perhaps Lindsey had the intention to determine the original paint colors, yet the scrape tests were carried out after the restoration work, post 1942. Or, Lindsey may have simply failed to document the findings of the scrape tests in his account.

The exact date of the scrape tests is uncertain but one can deduce they were conducted after 1938, when H. Rodney Sharp acquired the property, but prior to 1954. In John A.H. Sweeney’s article “The Corbit house at Odessa, Delaware” published in *The Magazine Antiques* published in April of 1954, he describes “the paints were scraped to find the original colors, and these were then duplicated, a thin coat of color being applied over a

³⁷ *Paint Layer Rectangles, The Corbit-Sharp House*, January 15, 1979, Historic Houses of Odessa Files.

white base.”³⁸ Sweeney restates in *Grandeur on the Appoquinimink* (first published in 1959), “the paints were scraped to determine the original colors of the woodwork; these have been reproduced in most of the rooms”.³⁹ For the purposes of this study, the scrape tests are referred to as ‘restoration-era’ and were performed some time between 1938 and 1954.

The analyses Sweeney alludes to are commonly called ‘scrape tests’ – a technique which involves carefully exposing areas of each layer of paint, beginning with the top layer of paint followed by each sequential layer down to what is thought to be the first paint generation. The scrape tests demonstrate the exceptionally conscientious efforts made during the restoration to identify the paint histories of the rooms. The scrape tests were meticulously performed by the investigators, yet due to limitations of the technique, incorrect conclusions were often drawn. Nevertheless, at the time, this was the accepted method to determine paint histories. Recent criticism regards scrape tests as an archaic method that provides only limited and incomplete information of the paint histories, misrepresents the original appearances of finishes, and does not provide helpful information regarding finish compositions.⁴⁰

Errors with the restoration-era scrape tests include: lack of distinction between successive layers of similarly colored paint, especially with white and off-white paints. Also, some generations include resin varnishes applied as a finish coat yet the scrape tests often did not distinguish these features. Such elements were missed with the scrape tests as they are not readily discernable with the naked eye. Another mistake frequently made with the

³⁸ John A.H. Sweeney, “The Corbit house in Odessa, Delaware,” *The Magazine Antiques* LXV, no. 4 (April 1954), 303.

³⁹ John A. H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (New York: University Publishers Incorporated, 1959), 78.

⁴⁰ Patrick Baty, “To Scrape or Not to Paint?” *Traditional Paint News* 1, No. 2 (October 1996), 9.

scrape tests was to misidentify white ground coats as finish coats of paint.

The next formal paint study was performed under the direction of Winterthur Museum. This study generated four Winterthur memoranda between May 31, 1978 and January 15, 1979. These documents are reproduced in Appendix C.

For the May 31, 1978 memorandum, the original colors of the parlor and first-floor, northwest chamber were examined by Winterthur paper conservator Anne Clapp and assistant paintings conservator Michael Heslip. Three methods were employed for the analysis: tooling with scalpels *in situ* (i.e. scrape tests), tooling of sections of doors and moldings removed from the house and relocated to the Winterthur laboratory, and cross-section analysis of paint chips under a microscope with reflected visible light. Documentation explaining the methodology employed for the cross-section analysis was not found in researching the Corbit-Sharp House files.

A memorandum from September 11, 1978 indicates that all rooms on the first and second floor, with the exception of the southwest rooms, were analyzed. The method of analysis used for this investigation is not known but perhaps they were the same as used for the May 1978 investigation. The September memorandum describes the original paint colors of the paneling, baseboard and chair rail, and, where possible, the original plaster wall finish. For certain areas, the original colors were matched to chips from the Munsell Color System, a universal color standard system; references to the appropriate chips are included in the memorandum.

A third memorandum dated December 5, 1978 indicates that the rooms had been

⁴¹ *Corbit-Sharp House: Restoring four rooms to original color*. December 5, 1978. Historic Houses of Odessa Files.

repainted to match the original colors as determined by the recent analyses.⁴¹ Ernest T. McCann, supervisor of the Winterthur Paint Shop, matched the original paints by eye with mock-up paint samples applied to paper cards; in most cases he lists the paint media and pigments used to achieve the paint matches. Some of these cards are presently located in the archives of Winterthur Library. As evidenced by the current paint analysis, modern, alkyd paints were applied in 1978 most likely to match the colors of the mock-up paint samples prepared by McCann.

As part of the continued effort to accurately determine the original paint colors, the restoration-era scrape tests were revisited, as described in a fourth memorandum dated January 15, 1979. It was recognized that several layers were not accounted for in the scrapes and that “the color applied in 1939 had also been daubed into the area representing the earliest level, thereby falsifying the documentary value of these rectangles”.⁴² The lowest paint layers were therefore reanalyzed to uncover possible earlier generations.

Despite the extensive documentation of the 1978-1979 Winterthur paint analysis, some aspects of the study were incompletely or imprecisely documented and thus difficult to fully understand. One problem lies in the fact that exact sample locations are not provided; this includes the location of paint chip samples, the location of *in situ* scraping tests, and the areas from which sections of molding and doors were removed for analysis at the Winterthur laboratories. The May 31, 1978 memorandum lists only the basic architectural elements that were apparently sampled while the September 11, 1978 memorandum does not report the methods of analysis. There is also ambiguity as to the precise colors that were identified, since color description is subjective. Although

⁴² *Paint Layer Rectangles, The Corbit-Sharp House*. January 15, 1978. Historic Houses of Odessa Files.

Munsell Color matches are reported in the September 11, 1978 memorandum, not all colors were matched to this standard system.

The findings of the previous paint analyses of each of the four selected rooms are summarized below.

Parlor

In *Grandeur on the Appoquinimink*, the parlor is described as “a dignified room, originally painted a soft moss green which has now been duplicated on the woodwork and plaster walls.”⁴³ This color would have been determined based on the restoration-era scrape test. The findings of the May 1978 Winterthur analysis state that the baseboards and chair rail of the parlor were originally a rich red-brown, the door to the hall was grained on both sides with a “lightish, variegated graining, probably meant to be mahogany”, and the rest of the woodwork was painted a light, warm grey.⁴⁴ The plaster was not tested because it had been recently painted.

According to the December 5, 1978 memorandum, the panels and trim were painted to match the original color, what is instead described by Ernest T. McCann as a light putty color.⁴⁵ The January 1979 re-analysis of the parlor scrape test finds that the:

“‘1939 Green’ covers the smallest rectangle. This was partially scraped to reveal, at the bottom edge, a tan that is darker than the tan chosen as original, due to the darkening of linseed oil after being covered by a later paint.”

Thus, the original color in the parlor as determined from the 1978 paint analysis – a putty

⁴³ John A. H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (New York: University Publishers Incorporated, 1959), 42.

⁴⁴ *Winterthur Memorandum: Original paint layers in the Parlor and Master Bedroom of the first floor of the Corbit-Sharp House*, May 31, 1978. Historic Houses of Odessa Files.

⁴⁵ *The New Shorter Oxford English Dictionary on Historical Principles*, s.v. “putty”. Putty-colour is defined as a light yellowish gray.

or tan color – was markedly different from the restoration-era scrape test – a soft moss green color.

First-floor, northwest chamber

On page 34 of the 1942 restoration account of the first-floor, northwest chamber, H.L. Lindsey writes, “The color of the original [space left blank by author]”. Nor does John A.H. Sweeney comment on the original paint colors in *Grandeur on the Appoquinimink*. Conclusions of the 1978 paint analysis are based on examination of the door to the hall and its architrave (known to be original) and the closet door to the right of the fireplace. The May 1978 report states:

“Records of changes in the room indicate that the right closet door was once removed to the second floor and then returned to the master bedroom in the restoration of the 1930s.”⁴⁶

However, this information is not documented in H.L. Lindsey’s restoration account, nor have other primary sources been found to verify this as fact.

Results given in the May 31, 1978 memorandum conclude that the door to the hall was grained on both sides and the rest of the woodwork was painted a light grey, cooler than the paint in the parlor. The plaster was not tested because it was likely not to be original. The second memorandum written on September 11, 1978, reports the original surface finish of the paneling to be

“formed by a glazing technique: on the wood lies a thin tan colored paint; over it, is a thin rather strong green which, in turn, is covered with a dark red-brown resinous coating”.⁴⁷

⁴⁶ *Original paint layers in the Parlor and Master Bedroom of the first floor of the Corbit-Sharp House*, May 31, 1978, Historic Houses of Odessa Files.

⁴⁷ *Conclusions Concerning the Colors of the Original Display Layers on a Number of Rooms in the Corbit Sharp House*, September 11, 1978, Historic Houses of Odessa Files.

It seems as though in the first report, from May of 1978, the grey base coat for the green glaze was simply mistaken for a finish coat.

Drawing room

The original paint colors of the drawing room as determined from the restoration-era scrape tests is not documented. The 1978 Winterthur analysis of the room established that the woodwork was originally a light grey-blue color that lies between Munsell Color chips 5B 8/1 and 5B 8/2, and the baseboard and top of the chair rail were painted a dark brown color. For the plaster,

“the color of the lowest calcimine paint that is present is a light rosy grey, close to Munsell Color chip 7.5YR 8/2.”^{48, 49}

Additional information yielded from the January 1979 analysis of the restoration-era scrape tests suggests that a cream-colored primer is present underneath the original blue paint of the woodwork.

Second-floor, southeast chamber

As with the first-floor, northwest chamber and the drawing room, the original colors of the second-floor, southeast chamber are not specified in Sweeney’s *Grandeur on the Appoquinimink* based on restoration-era scrape tests. The 1978 paint analysis of this room determined the original color of the paneling to be a “strong grey-green” close to Munsell Color chip 2.5GY 6/2, the baseboard and chair rail a dark brown, and the plaster “a very strong yellow ochre” that lies between Munsell Color chips 10YR 8/6 and 8/4.⁵⁰

⁴⁸ Calcimine paints refer to both glue distemper paints and paints containing casein as all or part of the binder. In the nineteenth-century, calcimine paints were defined as commercially prepared glue distemper paint. From Morgan W. Phillips. “A Victorian ‘Trompe l’Oeil,’” *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 156.

⁴⁹ *Conclusions Concerning the Colors of the Original Display Layers on a Number of Rooms in the Corbit Sharp House*, September 11, 1978, Historic Houses of Odessa Files.

⁵⁰ *Paint Layer Rectangles, The Corbit-Sharp House*. January 15, 1979. Historic Houses of Odessa Files.

The two previous paint studies of the Corbit-Sharp House were accomplished using the standard practices of the times. However, advances in paint analysis methodology since then take advantage of higher-powered microscopes, fluorescent microscopy, and biological stains to more accurately evaluate paint stratigraphies in cross-section. Current microscopic and chemical analysis techniques allow identification of the composition of original paint sequences – including the pigments, binders, additives, glazes, and varnishes of these layers.

CHAPTER 4

ANALYSIS OF INTERIOR DECORATIVE FINISHES

4.1. Methodology

Prior to on-site sampling of the finishes, H.L. Lindsey's 1942 restoration account was thoroughly reviewed in order to understand the interior alterations. Previous restoration activities therefore guided the locations of sample acquisitions in order to obtain original, first-generation finishes. The first round of samples was taken in August 2002 and based on the information provided, return visits were made for additional sampling. Additional sampling was necessary in areas where the first-generation paint was initially not found and where more data was needed to understand the full paint stratigraphies.

Cross-section microscopy in reflected visible and ultraviolet light was the first means of analysis in order to determine the original finishes in each room. Fluorescent staining of cross-sections was performed on representative samples as an initial, rapid indication of general binding media classification. Representative samples of first-generation paints were analyzed by Fourier-Transform Infrared (FTIR) microspectroscopy for compositional analysis of organic and inorganic compounds and with polarized light microscopy (PLM) for the identification of pigments. Based on the results of FTIR, select samples were analyzed by gas chromatography-mass spectroscopy (GC-MS) for more exact identification of organic components. Scanning electron microscopy – energy dispersive spectroscopy (SEM-EDS) was performed on samples where elemental information was necessary. Color matching with the use of a colorimeter was conducted on representative first-generation paints of the woodwork and plaster (where applicable) from the four rooms. All analyses were performed by the author with the assistance of others, as indicated.

4.1.1. Cross-section microscopy

Sampling

Small excavations, approximately 1/8 inch in diameter, were made on-site and examined *in situ* with a 30X hand-held monocular microscope to identify the most promising sample locations. Paint samples were then carefully taken with a microscalpel (Feather stainless steel surgical blade number 15) in order to include the complete paint stratigraphies and substrate intact. Documentation of samples taken in the four rooms is provided in Appendix D.

Cross-section Preparation and Photomicrograph Procedures

At the Architectural Conservation Laboratory at the University of Pennsylvania, the samples were examined at 30 times magnification (30X) with a stereomicroscope; the best portions of each sample were cast in polyester resin cubes for cross-section microscopy analysis and photography.

The samples were cast in mini-cubes, of approximately half inch widths, of polyester resin (Bioplast® liquid casting plastic with methyl ethyl ketone peroxide catalyst, Ward's Natural Science, Rochester, NY). The resin was allowed to cure for 24 hours or more at room temperature and under ambient light. The cubes were then cut with the diamond blade Buehler® Isomet™ low speed saw to expose the cross-sections, and dry, hand-polished successively with 1500 grit paper and then 8,000 and 12,000 grit micro-mesh polishing cloths. Finally, the samples were wet, hand-polished to a glassy-smooth surface with 0.05 micron Buehler® Micropolish II deagglomerated gamma alumina on a felt cloth.

4.1.1.1. Reflected visible and ultraviolet light

The cross-section samples were examined under reflected visible and ultraviolet light using an Olympus BHT Series 2 ultraviolet light microscope at 125X and 250X magnifications. Ultraviolet examination was done with the U filter in place, which has an excitation range from 300 to 400 nanometers with a 420 nanometer barrier filter. The best representational areas of each cross-section were photographed with Kodak Gold ASA 200 color print film and developed for visual interpretation.

Interpretation of cross-section stratigraphies and fluorescent staining results was conducted under the direction of Dr. Susan L. Buck.

Visual Interpretation of Cross-Sections

There are several indicators which can delineate different generations of surface finishes. To show that a surface has aged, evidence may exist such as cracks which extend through finish layers, accumulations of dirt between layers, and sometimes diminished fluorescence intensity – especially along the top edge of a surface which has been exposed to light and air for a long period of time.

Information Provided with Ultraviolet Light Microscopy

When viewed under reflected visible light, cross-sections which contain primer, base coats, top coats and varnish may often be difficult to interpret, particularly because clear finish layers look uniformly brown or tan. Therefore, it may be impossible using only visible light to distinguish between multiple varnish layers. Excitation with broad band, near ultraviolet light (360-420nm) provides more information about the sample stratigraphy because different organic, and some inorganic, materials autofluoresce with distinguishing, characteristic colors. Materials and strata not evident in visible light are

sometimes more apparent by virtue of ultraviolet (UV) illumination.⁵¹

There are certain fluorescent colors which indicate the presence of specific types of materials. For example, shellac fluoresces orange (or yellow-orange) when exposed to ultraviolet light, while plant resin varnishes (typically amber, copal, sandarac and mastic) fluoresce bright white under UV. Traditional linseed oil-based paints may fluoresce brightly in ultraviolet light depending on the pigment content and if they are oxidized enough. Wax does not usually fluoresce; in fact, in ultraviolet light it tends to appear almost the same color as the polyester casting resin. In visible light, wax appears as a somewhat translucent white layer. Materials such as lead white, titanium white, and hide glue have a whitish autofluorescence.⁵²

Although analysis of the first-generation surface finishes is the primary purpose of this study, the generational stratigraphies of the major architectural elements throughout the four rooms were determined for documentation purposes through visual examination of the cross-sections. They are also extremely helpful for paint archaeology to identify original and added architectural elements. Charts providing descriptions of the cross-section appearances in reflected visible and ultraviolet light are provided in Appendix E. Hypotheses as to approximate dates of finish generations were made, where possible, based on documentary research, primarily through examination of period photographs.

Color descriptions are subjective as they are based on the individual analyst's perception and vocabulary. In addition, colors as described from analysis of magnified cross-section photomicrographs may differ from the colors upon observation at the macroscopic level.

⁵¹ Richard Wolbers, "Fluorescence Microscopy", *Analytical Techniques in Conservation* (Workshop Notes, 1996), 3.

⁵² Ibid.

Furthermore, slight variations in color between the actual paint samples and cross-section photomicrographs result from the film development process (despite color corrections *not* made by the film developer). The analyst therefore made careful attempts to verify cross-section color descriptions against uncast samples at 30X magnification.

4.1.1.2. Fluorescent stains

Fluorochrome staining methods were introduced to the conservation field by Richard C. Wolbers, Associate Professor, University of Delaware and paintings conservator, and are described in his recent book on alternative cleaning methods for paintings and painted surfaces.⁵³ Select cross-section samples from the Corbit-Sharp House were stained with fluorescent stains to characterize the binding media in the various layers and to provide a better comparison between the different materials present in the layers. The following fluorescent stains were used for examination of the samples in ultraviolet light:

Tetraphenyl tetrazolium chloride (TTC)

4.0% w/v in ethanol to identify the presence of carbohydrates (starches, gums, sugars). Positive reaction color is dark red or brown.

Fluorescein isothiocyanate (FITC)

0.2% w/v in anhydrous acetone to identify the presence of proteins (tempera, animal glue, casein). Positive reaction color for proteins (free amino containing groups) is a yellow/green.

2,7-dichlorofluorescein (DCF)

0.2% w/v in ethanol to identify the presence of saturated and unsaturated lipids (oils). Positive reaction color for saturated lipids is pink and for unsaturated lipids is yellow.

Rhodamine B (RHOB)

0.06% w/v in ethanol to identify the presence of oils. Positive reaction color is bright orange.

⁵³ Richard C. Wolbers, *Cleaning Painted Surfaces: Aqueous Methods* (London: Archetype, 2000), 167-180.

N-(6-methoxy-8-quinolyl)-p-toluenesulfonamide (TSQ)

0.2% w/v in ethanol to identify the presence of zinc.

Positive reaction gives a brilliant sparkly blue appearance.

4.1.2. Polarized light microscopy

Polarized light microscopy (PLM) is a technique used to characterize and identify materials based on physical properties. The morphology and optical properties of particle samples provide immediate clues to their material composition. Morphological characteristics include the homogeneity of a sample as a whole, aggregations of particles and their sizes, and the shape and texture of individual particles. Optical properties include color, refractive index and extinction characteristics based on the absorption or refraction of plane and crossed polarized light.⁵⁴ For this study, PLM was performed in order to identify the pigments and materials used in the first-generation paints.

Pigment samples were taken from the first-generation paints using a tungsten needle, placed on the microscope slide, and dispersed with a scalpel. A single drop of fluid Cargille Meltmount™ (n=1.662) was placed on a cover slip, allowed to harden, and placed over the dispersed pigment sample on the microscope slide. The slide was then warmed on a hot plate to allow the Meltmount™ medium to flow to the edges.

Polarized light microscopy was performed using the Olympus CX31 microscope at the Architectural Conservation Laboratory, University of Pennsylvania. All PLM samples were examined by oil immersion at 1000X magnification; the ocular scale division was calibrated with a stage scale division such that 1 OSD = 0.97µm. Identification was based on observations of morphology and optical properties of the particles and was guided with examination of known reference materials and the use of the Particle

⁵⁴ Mayer, Debora D. "Polarizing Light Microscopy", *Analytical Techniques in Conservation* (Workshop Notes, June 2000), 2.

Atlas Electronic Edition (PAE² Particle Atlas 1992 MicroDataware). Polarized light microscopy was also carried out using the Olympus BHT Series 2 polarized light microscope with a polarizing light base; dispersed samples were examined at 500X magnification.

4.1.3. Instrumental analysis

Three methods of instrumental analysis were performed by the author at the Scientific Research and Analysis Laboratory, Winterthur Museum under the supervision of Janice Carlson, Senior Scientist. Mrs. Carlson assisted with the interpretation of FTIR spectra; additional help with instrumentation and analysis was provided by Dr. Jennifer Mass, Associate Scientist, with SEM-EDS and by Dr. W. Christian Petersen with GC-MS.

4.1.3.1. Fourier-transform infrared (FTIR) microspectroscopy

Fourier-transform infrared (FTIR) microspectroscopy is a method that provides compositional analysis of organic and inorganic compounds. The classes of natural organic binders typically found in surface finishes include oils, proteins, carbohydrates, and plant and insect resins. These materials may be characterized by their *general classes* using FTIR, whereas the specific identification of paint materials such as synthetic resins, inorganic pigments and natural minerals is possible.

With FTIR microspectroscopy, infrared radiation originates from a radiative heat source, passes through an interferometer, is directed at a sample, and is then focused on a detector. A compound light microscope is used to position the microgram quantity of sample required for analysis. Infrared energy is absorbed by the chemical bonds between atoms of the molecules within a sample; these different functional groups within the molecules absorb energy at certain characteristic frequencies. The interferometer

measures the infrared energy that passes through the sample in the form of a signal called an interferogram. Mathematical methods known as Fourier transforms convert the interferogram into an infrared spectrum, a graphical representation of absorption band wavelengths versus energy intensity. Energies that are absorbed by the sample are revealed as a series of characteristic absorption bands.

Although fluorescent stains provided some information about the organic binding material in the paint layers, several samples were chosen for further analysis with FTIR. Samples for FTIR analysis were prepared by lightly scraping surface paint from uncast samples with the aid of the Nikon SMZ800 stereomicroscope at 75X magnification, mounting on a diamond cell, and rolling flat to decrease thickness and increase transparency. Samples were analyzed using the Nicolet Nic-Plan IR Microscope; data were collected for 120 scans at a spectral resolution of 4cm^{-1} . Spectra were analyzed with Omnic E.S.P. 6.0 software.

4.1.3.2. Scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS)

Scanning electron microscopy - energy dispersive spectroscopy (SEM-EDS) is a technique used for the highly-magnified, topographical examination and compositional identification of a sample. SEM is of particular use in the examination of surface coatings and the stratigraphies of cross-sections.

To produce an image, a beam of electrons is directed at a specimen and scanned over its surface (made conductive by mounting to a support of carbon or aluminum and coating with a thin layer of carbon, silver, gold, gold/palladium, aluminum or chromium).

The primary electron beam interacts with the surface of the sample in several ways.

Secondary electrons are emitted from the surface atoms of a sample following an inelastic

collision with the primary electron beam. Backscattered electrons result from primary electrons that impinge on the sample in an elastic collision and are then reflected back. Both types of electrons are collected by dedicated detectors and converted to images. Backscatter images may also convey compositional differences within a sample; areas of higher average atomic number appear lighter than areas of lower average atomic number.

X-rays emitted when the primary electron beam interacts with surface atoms may be collected with an energy dispersive spectrometer – the method therefore known as energy dispersive spectroscopy (EDS). The x-rays energies are characteristic of the elements composing the area of interaction; therefore, SEM analysis coupled with an x-ray spectrometer (SEM-EDS) may be used to determine the elemental composition of a sample surface.⁵⁵ For this study, SEM-EDS data is displayed as spectra of x-ray emission energy (with peaks that correspond to characteristic elements) versus intensity and as elemental maps which provide the two-dimensional distribution of select surface elements.

To prepare the samples for SEM-EDS, the cast cross-sections were mounted to a carbon stub with carbon tape adhesive and carbon coated using the SPI-Module Carbon Coater with SPI-Module Control. Samples were examined using the ISI-DS 130 scanning electron microscope at an accelerating voltage of 20kV, stage height of 20mm, and sample tilt of 36°. The EDS data was analyzed with EVEX Microanalysis processor and software (version 2.0.441).

⁵⁵ Elemental analysis coupled with SEM may be abbreviated in several ways: SEM-XRF (x-ray fluorescence spectrometry), SEM-EDS (energy-dispersive spectroscopy), SEM-EDX (energy dispersive x-ray microanalysis), or SEM-EDAX (energy dispersive analysis by x-rays). Janice Carlson, Kate Duffy, and Albert Tagle. "Scanning Electron Microscopy", *Analytical Techniques in Conservation* (Workshop Notes, June 2000), 6.

4.1.3.3. Gas chromatography - mass spectrometry (GC-MS)

Gas chromatography - mass spectrometry is a technique that allows the qualitative and quantitative analysis and identification of organic compounds in a mixture by means of separating them into individual, chemical components. Gas chromatography is used to separate materials which contain mixtures of volatile components or mixtures whose components can be chemically modified to become volatile.⁵⁶ Whereas FTIR can determine general classes of organic materials, gas chromatography can readily differentiate between or separate specific organic components; mass spectrometry then is needed to identify these components.

With gas chromatography (GC), the mixture to be separated is dissolved in an organic solvent which is vaporized upon introduction to the instrument. The vaporized mixture is carried through a column by the flow of a gas, usually helium. Each chemical component of the mixture has a different affinity for the column substrate. This affinity, as well as instrumental parameters such as temperature, carrier gas and flow rate, determine how long it takes the individual components to travel through the column to the detector. The 'retention times' of the various compounds in the original mixture enables their tentative chemical identification by comparison with the retention times of standard reference compounds. The result is a chromatogram, a plot of quantity versus the retention time with each peak representing a separate component of the mixture.

Mass spectrometry coupled with gas chromatography (GC-MS) directs organic sample molecules, after they have passed through the GC column, at an electron beam within a mass spectrometer. The organic compound is ionized by the electron beam in the mass

⁵⁶ David Erhardt, et.al. "A Systematic Approach to the Instrumental Analysis of Natural Finishes and Binding Media", Reprints, 16th Annual Meeting, AIC. New Orleans, LA. (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 1988), 70.

spectrometer, the fragments are separated by size, and the resulting mass to charge ratio (m/z) of either the parent molecule or the resulting fragments are detected. With this data, a mass spectrum is generated for each compound; the abundance of the individual fragments is plotted versus its mass/charge ratio.

To prepare the samples for GC-MS, material was scraped from the surface of the desired paint layers and placed directly into a 0.3mL heavy walled GC vial. Samples were then treated with the derivatizing agent MethPrepII (0.2N methanolic solution of *m*-trifluoromethylphenyl-trimethyl-ammonium hydroxide, Alltech) which is designed to esterify and transesterify mixtures of fatty acids and their glycerides. To each GC vial, 100 μ L of MethPrepII reagent (diluted to a 1:2 MethPrepII to benzene solution) was added. The vials were then tightly screw-capped and heated at 60°C for one hour.

Samples were analyzed using the Hewlett-Packard 6890 gas chromatograph equipped with 5973 mass selective detector (MSD) and 7683 automatic liquid injector. The Winterthur RTLMPREP method was used with conditions as follows: inlet temperature was 300°C and transfer line temperature to the MSD (SCAN mode) was 300°C. A sample of (splitless) 1 μ L was injected onto a 30m \times 250 μ m \times 0.25 μ m film thickness HP-5MS column (5% phenyl methyl siloxane at a flow rate of 1.5mL/minute). The oven temperature was held at 50°C for two minutes, then programmed to increase at 10°C/minute to 325°C where it was held for 10.5 minutes for a total run time of forty minutes.

4.1.4. Color matching with colorimeter

After the target layers for color matching were identified through cross-section analysis, the first-generation paints of the four rooms were found in representative samples. Uncast portions of the samples (which had been carefully examined with the Nikon

SMZ800 stereomicroscope at 75X magnification to locate clean, relatively even areas of the earliest paint layers) were mounted to glass slides with a clear adhesive. To minimize the error of inaccurate color matching, the upper surfaces of the paint samples were lightly scraped to reveal protected areas of the paint before measurement with the colorimeter. However, it was important to achieve as flat a surface as possible since surface roughness can affect the results of color measurements. Color measurements were taken with the Minolta Chroma Meter CR-241, a tristimulus color analyzer with color measurement diameter of 0.3mm. The Chroma Meter has an internal, 360-degree pulsed xenon arc lamp and provides accurate color measurement in a choice of five different three-coordinate color systems.

Prior to each use, the colorimeter was calibrated with a white, reference plate. The paint samples were measured, at minimum, three times in three different areas of each exposed target layer. The measurements were generated in the Munsell color system (a color standard used in the architectural preservation field) and in the CIE LAB color space system, currently one of the most widely accepted industry color space measuring systems. The Munsell measurements were compared to the closest Munsell color swatches in the standard Munsell Book of Color (gloss paint standards). The match was then compared under 30X magnification to the actual paint samples.

The closest Munsell swatches were then used to find the closest visual commercial color swatch matches from among several paint lines including Benjamin Moore® Color Preview™, Sherwin Williams® COLOR™, Martin Senour Paints® Williamsburg Collection, Pratt and Lambert® color collection, and Do It Best Corporation® paint colors. The Chroma Meter was next employed to determine the commercial swatch with the closest Munsell and CIE L*a*b* values to the target paint layer. Measurements for

each target paint layer are provided in the analysis results section for each room. Color swatches from the best commercial matches have also been provided for reference and documentation.

Munsell Color System

The Munsell color system consists of a series of color charts which are intended to be used for visual comparison with the specimen. Colors are defined in terms of the Munsell hues (H), value (V), and chroma (C); Munsell colors are written as H V/C.

CIE LAB Color System

The CIE (Commission Internationale de l'Eclairage) LAB system, represented as $L^*a^*b^*$, identifies colors mathematically and more closely represents human sensitivity to color. Equal distances in this system approximately equal perceived distances in color. The system references colors with respect to: white to black (lightness variable, L^*); red to green (chromaticity coordinate, a^*); and yellow to blue (chromaticity coordinate, b^*).

Calculation of ΔE

The calculation of ΔE is the industry measure used to determine how closely two colors match in the CIE $L^*a^*b^*$ color system. The color difference, or ΔE , equals the square root of the squared sums of the differences between each of the three $L^*a^*b^*$ tristimulus values; the calculation is: $\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$. Industry color standards indicate a $\Delta E \approx 1$ is barely perceptible to the human eye, and ΔE of 6 to 7 is acceptable for color matches in the printing industry.

4.2. Results - Parlor

4.2.1. Cross-section microscopy

4.2.1.1. Reflected visible and ultraviolet light

The wood substrate of samples from the parlor shows evidence of a shellac sealant within its fibers, visible in ultraviolet light as a pale orange autofluorescence. Above the wood substrate is a white primer layer followed by a stone color finish paint. Both layers have a strong autofluorescence in ultraviolet light (Figure F-1b., sample 64).

Sample 13, from the parlor baseboard, also shows evidence of a shellac sealant within the fibers of the wood substrate. The first generation consists of a white primer, dark brown top coat, and translucent, resinous finish coat. The dark brown top coat is an example of a paint *not* composed of a white-pigmented base; this composition would have provided a particularly intense dark color. The finish coat likely consists of a plant resin due to its whitish fluorescence in ultraviolet light (Figure F-7b., sample 13).

The door to the hall was originally grained. In cross-section graining appears as a series of four layers, as seen in sample 102 (Figure F-12). Above the wood substrate is a white primer layer, the second layer is a yellow base coat which provides the background color of the wood it is to imitate, the third layer is a red-pigmented glaze in which the wood graining is emulated, and the fourth layer is a protective, resinous varnish layer (possibly a plant resin varnish due to its whitish fluorescence in ultraviolet light). It is possible the graining was intended to imitate mahogany based on the yellowish base coat.

Sample 100 was taken from the plaster wall of the parlor above the right window architrave. Careful attention was made to acquire the original browncoat and plaster of the wall. Coarse hair strands are seen in the browncoat of the uncast sample with

examination at 30X magnification with a stereomicroscope. The upper paint generations separated from the plaster substrate during sampling; the two parts were cast separately and therefore are shown in two series of cross-section photomicrographs (Figures F-10 and F-11, sample 100). Above the coarse, granular brown coat is a thick layer of white, plaster finish coat. Applied to the surface of the white coat is a thin translucent tannish layer. The bright white autofluorescence of this layer in ultraviolet light is characteristic of limewash, which would act a temporary finish for the wall while the plaster cured. Directly above the limewash is a relatively thick, opaque, off-white paint. There is no evidence of wallpaper fibers above the plaster substrate or limewash of the parlor wall to indicate the possible existence of wallpaper in the first generation.

Paint analysis of the parlor during Sharp's ownership was based on scrape tests which determined the original paint color to be a "soft moss green"; the stone colored paint layer below the green was assumed to be the primer. The 1978-1979 Winterthur analysis of the room interprets the stone color as the original finish coat, a conclusion which this study confirms.⁵⁷ An obvious, visual distinction between the two layers is seen in cross-section; a varnish, possibly oil-based, is applied above the stone color paint of the first generation (Figure F-3, sample 4). Such a finish would have given the relatively glossy paint a more saturated appearance.

4.2.1.2. Fluorescent stains

Fluorescent staining of sample 13 (from the baseboard) suggests the presence of oil within the wood substrate. These samples show a positive reaction to DCF for the presence of unsaturated lipids as indicated by a bright yellow reaction color in reflected ultraviolet light (Figure F-7c., sample 13).

⁵⁷ Michael Heslip describes the original color as tan.

Fluorescent staining of cross-sections did not provide conclusive information regarding the binding media of the first-generation paints. It may be possible to observe fluorescent staining reactions in the first-generation paints at higher magnifications. However, positive fluorescent staining reactions are observed in later generations. Fluorescent staining of cross-section samples with FITC to test for the presence of proteins, DCF to test for the presence of lipids, and TTC to test for the presence of carbohydrates all give positive reactions in the fifth, sixth and seventh generation white paints (Figures F-2c., F-3c. and F-4c., samples 2 and 4); this data suggests these generations to be composed of emulsion paints. Emulsion paints consist of a mixture of protein (often casein), oil and carbohydrate media. A positive reaction with TTC for the presence of carbohydrates is also evident in the eighth, ninth and tenth generation paints.

Sample 100 from the plaster wall was stained with TTC to test for the presence of carbohydrates (Figures F-10c. and F-11c., sample 100). Wallpaper paste residue, usually in the form of a wheat starch paste, is a carbohydrate-based material. In cross-sections where wallpaper is known to have existed, the positive deep red reaction color for the presence of starch paste is usually seen as a thin line below the paper surface. Starch paste that penetrates cracks within the substrate or earlier finish layers will also produce a red reaction when exposed to TTC. While positive reactions for the presence of carbohydrates are apparent in the cross-section, the pattern of staining does not provide compelling evidence for the presence of wallpaper paste above the limewash. This analysis does not definitively conclude that the walls of the parlor were not wallpapered in the first generation. One can only say that conclusive evidence of a wallpaper treatment was not found in the sample analyzed.

The paint above the plaster substrate of sample 100 was stained with TSQ to test for the

presence of zinc. A positive reaction is seen in the first-generation paint layer as a bluish, sparkly appearance (Figure F-11d., sample 100). This suggests the presence of zinc but is not considered to be a conclusive identification. Zinc may be present as zinc white (ZnO) which would indicate an application date post 1834.

4.2.2. Polarized light microscopy

Stone color woodwork

The first-generation stone-color paint of the woodwork from samples 9, 18 and 63 were isolated for pigment identification with polarized light microscopy. When viewed at 500X magnification, the pigment particles are white with an average particle size of approximately one micrometer (1 μm). The majority of particles have index of refraction higher than 1.66. The particles also have a positive, high relief meaning the particles' index of refraction differs from the mounting medium by 0.12 or more ($n_{\text{particle}} > 1.78$).⁵⁸ With crossed polars, some anisotropic, birefringent particles are visible. Both isotropic and anisotropic particles are seen simultaneously at slightly crossed polars (20°). The white particles are highly birefracting. These properties indicate pigment identifications of lead white with a small amount of whiting.

Additional pigments are observed in the dispersions but only at an extremely low concentration. Anisotropic red and orange particles are observed that have a refractive index greater than 1.66; this classifies the particles in the iron oxide category, with more specific identification as red ochre. Multiple sampling of the stone-colored paint was required to obtain a dispersion with a definitive amount of red ochre particles. This suggests that the paints were extremely finely ground and the pigments well dispersed

⁵⁸ Relief is only an estimation of refractive index. "Identification of an Unknown Particle, Experiment 2: Determine Relief," University of Pennsylvania, Graduate Program in Historic Preservation, Architectural Conservation Laboratory, Preservation Workshop: Microscopy of Building Materials. HSPV624-003-2003A.

throughout the paint, an indication of a high level of craft of those preparing the paints.

Dark brown baseboards

The first-generation dark brown paint of sample 13 was isolated for PLM examination. Red-orange pigment particles, approximately one micrometer (1 μm) in size, are visible at 1000X magnification. The index of refraction of the particles is greater than 1.66 and the particles have a positive, high relief to indicate the particles' index of refraction differs from the mounting medium by 0.12 or more ($n_{\text{particle}} > 1.78$). Crossed polars yield a complete black field of view indicating the particles are isotropic. These characteristics indicate the pigment to be from the class of iron oxides and are more specifically identified as red ochre. A considerably smaller amount of lead white and whiting is identified in the dispersion.

White paint of plaster walls

Zinc white particles are identified in the dispersed pigment sample of the first-generation paint from the plaster wall, sample 100. The particles closely match a reference dispersion of zinc white; the particles have an index of refraction greater than 1.66 and are only slightly birefracting. The presence of zinc white is supported with a bright yellow fluorescence of the particles as viewed under ultraviolet light.⁵⁹ The presence of zinc white dates the application of the paint to post-1834; therefore, the paint was not present during William Corbit's lifetime (1746-1818). Whiting is also identified in the pigment dispersion.

⁵⁹ Rutherford J. Gettens and George L. Stout, *Painting Materials: A Short Encyclopedia*, (New York: Dover Publications, Inc., 1966), 177.

4.2.3. Instrumental analysis

4.2.3.1. FTIR microspectroscopy

Table 1 outlines the results of samples from the parlor analyzed by FTIR.

TABLE 1: FTIR MICROSPECTROSCOPY RESULTS – PARLOR				
SAMPLE	ARCHITECTURAL ELEMENT	GENERATION	MATERIAL	FTIR IDENTIFICATION
9	surbase	first	paint; stone color	lead white in drying oil whiting (calcite)
		fifth	paint; white color	metal pigment in drying oil barium white
11	surbase	first	paint; stone color	lead white in drying oil
17	door pediment	fifth	paint; white color	metal pigment in drying oil whiting (calcite) barium white
19	door architrave	eleventh	paint; cream color	whiting (calcite) alkyd resin
85	base	first / second	paint; brown color	metal pigment in drying oil barium white
100	wall plaster	first	paint on plaster; off-white color	metal pigment in drying oil barium white oil
			plaster sealant; slight tannish color	whiting (calcite) gypsum (contaminant) oil
		substrate	plaster substrate; white color	lime (calcite)

As observed in cross-section photomicrographs, the first-generation, stone color paint of surbase sample 9 is representative of the first-generation paint of the wainscots, chimney breast panels, door architrave and pediment, window architrave, mantel, overmantel, and crown molding. The first-generation paint of sample 9 produces a spectrum that most closely represent the composition of a metal drier in a drying oil; the spectrum closely matches the reference spectrum for lead white in linseed oil (Figure H-1a., sample 9). The strongest peak in the spectrum occurs at 1406cm^{-1} and is due to carbonate (CO_3^{2-}) stretches most likely from lead white, basic carbonate ($2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$). Lead white

also contributes to stretches at 682 and 3537 cm^{-1} . A reference spectrum for lead white in linseed oil is provided for comparison with the first-generation paint of sample 9.

The strong peak at 1518 cm^{-1} results from carbon-oxygen stretching characteristic of the chemical reactions between metal ions, such as lead, and drying oils. The ester linkages of the fatty acid components of oils are hydrolyzed and complex with metal ions to form organic acid salts. A reference spectrum of a commercial lead drier is shown to indicate the contribution of the carbonyl (C=O) stretch of the organic acid salt between 1600 and 1500 cm^{-1} .

The fatty acids of the drying oil contribute to hydrocarbon (C-H) stretches ranging from 3000 to 2800 cm^{-1} and a carbonyl stretch around 1734 cm^{-1} , due to the ester group. The frequency of the carbonyl is lower than that of unaged oils due to crosslinking that occurs over time.

Calcite (calcium carbonate, CaCO_3) is also evident in the first-generation paint of sample 9 as detected by the weak, yet sharp, carbonate (O-C-O) bending band at 875 cm^{-1} . Carbonate stretching bands from calcite overlap with those produced from lead white. Calcite, also known as whiting, would have been added to the paint as an extender.

The FTIR spectrum of the first-generation, dark brown paint of the base indicates a composition of a metal pigment in a drying oil, most likely lead white in linseed oil (Figure H-2a., sample 85). The spectral peaks may be interpreted the same way as for spectra from the first-generation paints of samples 9 and 11. A second spectrum of the sample indicates stretches between 1050 and 1180 cm^{-1} possibly due to the presence of asymmetric sulfate (SO_4^{2-}) stretching bands of barium white (barium sulfate, BaSO_4)

(Figure H-2b., sample 85). The presence of barium white dates to an early nineteenth century *terminus a quo* of the paint generation. Therefore, it is likely that when sampling for FTIR microanalysis of the first-generation, the second-generation, dark brown paint was incidentally sampled. Although visible in the cross-section photomicrograph at 125X magnification as separate, distinct first and second dark brown paint layers (Figures F-7, sample 13), it would be difficult to separate and distinguish the layers for FTIR sample preparation – even with the aid of the stereomicroscope.

Material taken from within the plaster wall substrate of sample 100 shows an FTIR spectrum of only calcite, or lime (Figure H-3a., sample 100). Plaster material scraped from the top surface of the plaster – intended for analysis of the plaster sealant – shows evidence of gypsum (calcium sulfate dihydrate, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) in addition to calcite (Figure H-3b., sample 100). Relatively strong antisymmetric and symmetric O-H stretching bands are seen at 3533 and 3404cm^{-1} and an asymmetric sulfate (SO_4^{2-}) stretching band occurs at 1118cm^{-1} . It is believed the presence of gypsum is a contaminant accidentally acquired with sampling. An oil contributes to hydrocarbon (C-H) stretches at 2920 and 2851cm^{-1} and a carbonyl stretch at 1741cm^{-1} ; the oil is likely from the paint above.

Material from sample 100 of the first-generation paint above the plaster yields a spectrum showing the presence of a metal soap, barium white (barium sulfate, BaSO_4), and oil, possibly linseed oil (Figure H-3c., sample 100). The strong peaks at 1575 and 1418cm^{-1} result from C-O stretching characteristic of the chemical reactions between metal ions and drying oils. Among the strongest peaks of the spectrum are asymmetric sulfate (SO_4^{2-}) stretches at 1173 , 1115 , and 1078cm^{-1} ; a small, sharp confirmatory peak at 983cm^{-1} confirms the presence of barium sulfate in the sample with confidence. Again,

an oil contributes to hydrocarbon (C-H) stretches at 2926 and 2854 cm^{-1} and a carbonyl stretch at 1739 cm^{-1} .

Despite the positive reaction for carbohydrates with staining of sample 100 with TTC, FTIR analyses of the limewash and first-generation paint do not indicate the presence of a carbohydrate component.

For reasons that will be explained in the following SEM-EDS section (B.3.b.), FTIR analysis of the fifth-generation, white paints of samples 9 and 17 and eleventh-generation, dull cream-color paint of sample 19 was performed. The purpose of analysis for these paint layers was to test for the presence of barium white (barium sulfate, BaSO_4). Peaks corresponding to sulfate (S-O) stretches are seen in the fifth-generation, white paint of samples 9 and 17 in the region of 1200 to 1050 cm^{-1} and suggest the presence of barium sulfate (Figures H-1b. and H-4, samples 9 and 17). The identification of barium sulfate is supported by the presence of barium detected by SEM-EDS in the fifth generation paint of sample 61 (*vide infra*). The spectra of the fifth-generation, white paint of samples 9 and 17 indicate the major composition to be a metal pigment in drying oil with strong C-O stretches at 1578/1588 cm^{-1} and 1417/1418 cm^{-1} , hydrocarbon (C-H) peaks at 2927/2928 cm^{-1} and 2854/2856 cm^{-1} , and carbonyl (C=O) stretches at 1734/1739 cm^{-1} . The presence of calcite exists in sample 17 as evidenced by the weak, yet sharp, carbonate (O-C-O) bending band at 878 cm^{-1} . Carbonate stretching bands from calcite overlap with those produced from the metal ion - drying oil interaction.

Sulfate peaks are not evident in the spectrum of the eleventh generation of sample 19 which suggests that the layer does not contain barium white (Figure H-5, sample 19). The major components of this sample detected by FTIR are calcite and an alkyd resin.

It is possible that the eleventh generation paint may be based on zinc white (zinc oxide, ZnO) and/or titanium white (titanium dioxide, TiO₂) but identification of these pigments by FTIR is not possible because they do not absorb in the mid-infrared region of the electromagnetic spectrum.

4.2.3.2. SEM-EDS

SEM-EDS analysis of sample 61 from the parlor overmantel was performed to gain an overall understanding of the elemental composition of the stratigraphies. For the generations where pigment identification with PLM was not performed, elemental analysis with SEM-EDS may suggest the use of certain pigments in successive paint layers. This information can help to approximate the date of application of paint layers based on the initial date of a pigment's manufacture. For example, the presence of zinc may be attributed to the pigment zinc white and would indicate an application date after 1834, the first year zinc white was commercially available.⁶⁰ Likewise, the presence of titanium from titanium white would indicate the application of the paint post circa 1919.⁶¹

Elemental mapping of sample 61 is shown in Figure I-1c.; lead is the primary element detected in generations one through four of sample 61. This analysis supports the PLM identification of lead white contained in the first-generation paint. The major element detected in the fourth, fifth, and sixth generation paints is zinc most likely attributed to the pigment zinc white (Figure I-1d., sample 61). As previously stated, this indicates the date of application to be after 1834.

With one respect, however, the results as displayed by elemental mapping are somewhat

⁶⁰ Rutherford J. Gettens and George L. Stout. *Painting Materials: A Short Encyclopedia*, (New York: Dover Publications, Inc., 1966), 177.

⁶¹ *Ibid.*, 161.

misrepresentative. According to elemental mapping, barium is the major element detected in the eleventh generation paint layer. Yet the spectrum produced from SEM-EDS spot analysis of the eleventh generation paint does not produce the characteristic pattern with three barium energy peaks at 4.465keV (L_{a1}), 4.827keV ($L_{\beta1}$) and 5.156keV ($L_{\beta2}$). Instead, the peaks more closely match those attributed to titanium, with peaks at 4.510keV (K_{a1}) and 4.931keV ($K_{\beta1}$) (Figure I-1e., sample 61).

The reason for the disparity between the two forms of data is that the elements barium and titanium produce x-rays of overlapping energies and the computer cannot distinguish between the sources of those x-rays. In the case of sample 61, when programmed to map barium as the L_{a1} peak energy, the spectrometer will also detect energies attributed to the K_{a1} peak of titanium. The different elements are not distinguished when mapped, however, and those areas of titanium will visually be represented as barium. So as a result, the elemental map of sample 61 shows the eleventh generation as containing predominately barium when in fact the major element in this layer is titanium. The data from the elemental mapping can be misinterpreted if EDS spectra are not collected from each layer before beginning the mapping process.

Sample 13 from the parlor base was also analyzed by SEM-EDS (Figure I-2b.). Elemental spot analysis of the first-generation paint (Figure I-2c.) detects the presence of iron as the major element; other elements detected are lead (Pb), calcium (Ca), and silicon (Si). Iron may be attributed to iron oxide red (Fe_2O_3), lead from lead white ($2PbCO_3 \cdot Pb(OH)_2$), and calcium from calcium carbonate (whiting, $CaCO_3$); the presence of these minerals is confirmed by PLM analysis. Silicon and copper may be present as clay impurities within the iron oxide matrix.

Elemental spot analysis of sample 100 from SEM-EDS detects the presence of calcium and zinc in the first-generation paint (Figures I-3c.). The detection of zinc is likely attributed to zinc white (ZnO); this identification is confirmed with polarized light microscopy (see Section 4.2.2) and indicates an application date post 1834. While the white paint appears to be the first paint layer above the plaster substrate, it was not present during William Corbit's lifetime (1746-1818).

4.2.3.3. GC-MS

GC-MS analyses were performed on samples 13, 17, and 63 in order to more accurately determine the paint binding media as compared to the information provided by cross-section fluorescent staining and FTIR analyses. For samples 13 and 63, from the parlor base and wainscot, respectively, the composition of the original finishes was analyzed; for sample 17, the fifth generation white paint was analyzed. FTIR analysis of the fifth generation paint indicates an oil-based binding media while fluorescent staining tests positive for the presence of proteins and carbohydrates; this data suggests the presence of an emulsion paint. Unfortunately, GC chromatograms and MS spectra of the three samples did not yield identifiable peaks and thus the results are inconclusive (Figure J-1).

4.2.4. Color matching with colorimeter

Sample 19 – door to hall, architrave

First-generation paint

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 2.0Y	V (value) 7.1	C (chroma) 2.7
CIE L*a*b*	L* (black to white) 71.84	a* (green to red) +0.86	b* (blue to yellow) +18.20

Sherwin Williams® COLOR™ SW 6143 “Basket Beige”

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 2.5Y	V (value) 7.0	C (chroma) 2.7
CIE L*a*b*	L* (black to white) 71.47	a* (green to red) +0.39	b* (blue to yellow) +18.84

NOTE: Color match is not provided due to lack of printer calibration for color rendering.

The ΔE value for the color difference between the first-generation paint layer of Corbit-Sharp House parlor sample 19 and the best commercial match, Sherwin Williams® COLOR™ SW 6143 “Basket Beige”, is $\Delta E = 0.88$. The commercial color swatch is an excellent numeric as well as visual match.

Sample 13 – baseboard
First-generation paint

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 2.0YR	V (value) 3.3	C (chroma) 2.1
CIE L*a*b*	L* (black to white) 34.30	a* (green to red) +8.12	b* (blue to yellow) +8.58

Benjamin Moore® Color Preview™ 2113-10 “chocolate sundae”

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 8.9R	V (value) 3.3	C (chroma) 2.1
CIE L*a*b*	L* (black to white) 34.02	a* (green to red) +9.02	b* (blue to yellow) +6.48

NOTE: Color match is not provided due to lack of printer calibration for color rendering.

The ΔE value for the color difference between the first-generation paint layer of Corbit-Sharp House parlor sample 13 and the best commercial match, Benjamin Moore® Color Preview™ 2113-10 “chocolate sundae”, is $\Delta E = 2.30$. The commercial color swatch is a good numeric as well as visual match. This color is also the best commercial match to the baseboard paint of the drawing room and second-floor, southeast chamber but with ΔE values of 3.12 and 4.39, respectively. The slight variation in color is due to differences in the batches of hand-ground paints.

4.2.5 Summary

The original finish of the parlor paneling and woodwork was a stone-colored, oil-based paint containing lead white, whiting, and red ochre. The baseboards were a dark brown, oil-based paint composed primarily of red ochre. The door to the hall was grained likely to imitate mahogany. The original finish of the eighteenth-century plaster walls was not present in the sample acquired; further work is necessary to sample and identify plaster with the original finish. A summary of the first-generation finishes of the parlor are outlined in Table 2.

TABLE 2: SUMMARY OF FIRST-GENERATION FINISHES PARLOR				
ARCHITECTURAL ELEMENT	FINISH	MATERIAL COMPOSITION		
		PLM	FTIR	SEM-EDS
paneling and woodwork	stone color paint	lead white whiting red ochre	lead white in drying oil calcite	lead
baseboards	dark brown color paint	red ochre lead white whiting	metal pigment in drying oil	iron lead calcium silicon copper
door to hall	grained to imitate mahogany	<i>not analyzed for composition</i>	<i>not analyzed for composition</i>	<i>not analyzed for composition</i>
plaster walls	unknown	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>

4.3. Results – First-floor, northwest chamber

The first-floor, northwest chamber underwent significant changes in design during the late nineteenth century. As a consequence, in order to return the configuration of the room to its eighteenth-century appearance, much of the woodwork in the room dates to the 1938-1942 restoration. Samples with original finishes include those taken from the door to the hall, the door architrave and pediment, and the closet door to the right of the fireplace.⁶² Plaster from the wall was not sampled because it is documented to have been hacked and recoated during the restoration.

4.3.1. Cross-section microscopy

4.3.1.1. Reflected visible and ultraviolet light

The wood substrate of samples from original woodwork shows evidence of a shellac sealant within its fibers, visible in ultraviolet light as a pale orange autofluorescence. The original finish of the first-floor, northwest chamber was found to consist of a thin, white primer layer followed by a gray base coat and brilliant green finish coat (Figures F-15c. and F-15d., sample 66). Individual green pigment particles are seen in raking light suspended within the layer (Figure F-15b., sample 66). The lack of autofluorescence of the green layer in ultraviolet light was an immediate clue that the paint possibly consisted of a verdigris paint or copper resinate-based glaze.

Verdigris is a bluish-green pigment, typically the dibasic acetate of copper ($\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{Cu}(\text{OH})_2$), that readily decomposes to a brown color upon long-term

⁶² The May 31, 1978 Memorandum regarding the original paint layers of the first-floor, northwest chamber it is stated that: "Records of changes in the room indicate that the right closet door was once removed to the second floor and then returned to the master bedroom in the restoration of the 1930's". No primary documentation has been found that supports the identification of the closet door as original to the room; there is no mention as to the origin of the closet doors in H.L.Lindsey's restoration account. This paint analysis, however, confirms the 1978 statement since the first generation finish of the right closet door matches that of the door architrave.

exposure to air. It was applied in the eighteenth century either as an opaque paint mixed with lead white in oil, or was used on its own in oil as a glaze. Copper resinate, on the other hand, is formed by dissolving verdigris in resin by the use of heat and is thus applied as a translucent glaze.⁶³ The use of a light base coat, typically an opaque blue-gray color, is traditional craft practice to make the semi-translucent green glaze appear brighter and more intense. Its translucency also dictated the application of multiple coats of the glaze.⁶⁴ This paint surface would have originally been very glossy.

Period recipes give an indication of the finish compositions of verdigris-based paints and varnishes. Two recipes from Hezekiah Reynolds *Directions for House and Ship Painting* (1812) are given:

Parrot Green

Prime with white, tinged with lampblack as directed; and for the last two coats, use five pounds white Lead, one pound of Verdigris, and four ounces of Spruce yellow, or in that proportion.

Grass Green

Prime as above, and for the last two coats, use equal quantities of Verdigris and white Lead. Add to the last mentioned colors, Spirits of Turpentine in the proportion of half a pint to each gallon of paint.

⁶³ Ian C. Bristow, *Interior House-Painting Colours and Technology*, (New Haven: Yale University Press, 1996), 23.

⁶⁴ Frank S. Welsh, "The Early American Palette: Colonial Paint Colors Revealed," *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 75.

An unidentified cabinetmaker's receipt book (1794-1800) in the Winterthur Library collection provides directions for finishing chairs:

For green chairs with Verdigris grind $\frac{1}{4}$ lb verdigris on a stone as much as will enable you to grind it in as much oil as will enable you to grind it even in a very thick paste then remove it aside and repeat the same till the whole be ground then add & stir in 1 pint of common varnish in half an hour it will be ready for use-----1 pint of this will give one coat to 8 chairs after they have been primed with the following (viz) white lead and lamp Black dry them in the Sun & Day and then they will be fit for laying the above paint of which you will lay two coats & they will both Dry in one day.

It is interesting to note that both recipes specify that the verdigris-based finish should be applied over a white lead primer (or base coat) tinted with lamp black; the same composition appears to have been used as the first-generation gray primer on areas of original woodwork of the first-floor, northwest chamber.

Instructions for a verdigris-based varnish in Mackenzie's *Five Thousand Receipts* (1829) are described as follows:

To make sea green for varnish and oils

Varnish requires that this colour should possess more body than it has in distemper; and this it acquires from the oil which is mixed with it. This addition even gives it more splendour. Besides, a green of a metallic nature is substituted for the green of the Dutch pink, which is of a vegetable nature. A certain quantity of verdigris, pounded and sifted through a silk sieve, is ground separately with nut oil, half drying and half fat; and if the colour is intended for metallic surfaces it must be diluted with camphorated mastic, or gallipot varnish.....

If this colour be destined for articles of a certain value, crystallized verdigris, dried and pulverized, ought to be substituted for common verdigris, and the painting must be covered with a stratum of the transparent or turpentine copal varnish.

Yet another period recipe for a verdigris-based varnish is provided in W. and T.J. Towers' *Every Man His Own Painter* from 1830:

Bright varnish green for inside blinds, fenders, wire, tin work, &c.

The work must first be painted once over, with a light lead color in oil; and when dry, grind some white lead in spirits of turpentine; afterwards take about one third in bulk, of verdigrease, which has been finely ground stiff in linseed oil; then mix them both together and put into it a little resin varnish; sufficient only, to bind the color. When this is perfectly hard, which will be the case, within fifteen minutes, pour into the color some resin varnish to give it a good gloss. Then go over the work a second time; and if another coat is required, paint it over a third time. Thus you will have a cheap and beautiful green, with a high polish. It possesses a very drying quality; as the work may be completed in a few hours. The tint may be varied according to fancy; by substituting mineral green for the verdigrease; and if a bright grass green is required, add a little Dutch pink to the mixture.

N.B. This color must be used when quite warm, in order to give the varnish a uniform extension.

Evidence of original finish on the first-floor, northwest chamber door (to the hall) is scant despite four samples taken from this element. The best evidence is seen in the cross-section photomicrograph of sample 87 (Figure F-21). The first layers above the wood substrate contain remnants of a white primer and dark red-brown top coat. The next generation above this is the graining sequence presently seen on the door; it consists of a thick, opaque cream-color layer (no autofluorescence in UV light) with translucent synthetic varnish (dull autofluorescence in UV light). This stratigraphy suggests that the door was intentionally stripped, a conclusion that is confirmed in the December 5, 1978 Winterthur memorandum.⁶⁵

A second photomicrograph of sample 87 shows similar white and red-brown paint layers as to the first-generation paints yet in a disrupted, undulating pattern (Figure

⁶⁵ Note 2 at the end of the memorandum states: "Master Bedroom (door entering room) paint was removed from interior side of door. Old layers of paint had deteriorated down to wood surface. By not removing, new finish would be impossible to keep on door." See Figure C-3, page 3.

F-22, sample 87). This effect is typically the result of a heat-applied method used to facilitate mechanical stripping of the paint. From what is observed of the two sets of photomicrographs, it is surmised that the original finish, and possibly later finishes, on the door of the first-floor chamber was a dark red-brown paint.

The 1942 restoration account explains that a “new chair rail and washboard, etc., were made from old material and erected in their respective places”. As a result, cross-section photomicrographs of samples from the surbase and baseboard show only four paint generations; the first-generation brilliant green finish coat found on the door architrave and closet door is not present in samples from the surbase and baseboard (Figure F-23, sample 68). The first-generation paint above the wood substrate is a greenish gray paint, the origin of which is unknown; the first finishes applied during the Sharp restoration are the white base coat and red finish coat.

Sample 69, from the side panel of the right window, is a piece of restoration woodwork. The cross-section photomicrograph shows a different first-generation paint scheme (gray primer with blue finish coat) while the successive layers match those found on the other restoration woodwork samples (Figure F-24, sample 69). The restoration woodwork is therefore collected from a variety of sources of “old material”.

During the ownership of Daniel Wheeler Corbit, from 1877 to 1922, the wall between the first-floor, northwest chamber and the parlor had been opened on either side of the fireplaces to permit circulation between the two rooms. The paint evidence from the two rooms shows the same white paints applied in later generations in these spaces; specifically, the fifth and seventh generation paints of the parlor match the fourth and fifth

⁶⁶ The sixth generation paint of the parlor is also a white color.

generation paints of the northwest chamber, respectively (Figures F-4 and F-20, samples 4 and 88).⁶⁶

4.3.1.2. Fluorescent stains

Fluorescent staining of a sample from original woodwork suggests the presence of oil within the wood substrate; the sample shows a positive reaction to DCF for the presence of unsaturated lipids as indicated by a yellow reaction color (Figure F-15e., sample 66). Fluorescent staining reactions are not observed in the first-generation green finish due to its dark appearance in UV light.

4.3.2. Polarized light microscopy

Green finish

A dispersed pigment sample of the green finish from sample 88 appears as a mixture of white particles and irregular-shaped green particles (Figure G-1a., sample 88). The white particles are identified as lead white and whiting. Large black particles that are observed may be verdigris that has perhaps decomposed to copper oxides or copper sulfides. Individual verdigris particles were not isolated despite multiple preparations of pigment dispersions; however, distinct green particles are observed in the cross-section photomicrographs to suggest the presence of verdigris pigment. The irregular-shaped green material is consistent with the known optical properties of copper resinate: glassy, irregular green fragments with a refractive index less than 1.66.⁶⁷

Observation of the dispersed pigment sample in UV shows bright white autofluorescence indicative of a plant resin – information that supports the presence of copper resinate

⁶⁷ The refractive index of copper resinate is given as about 1.52. Hermann Kühn, "Verdigris and Copper Resinate," *Artists' Pigments: A Handbook of Their History and Characteristics, Volume 2*, Roy, Ashok, ed. (Washington, D.C.: National Gallery of Art, 1993), 150.

(Figure G-1c., sample 88). Autofluorescence is seen in the dispersed pigment sample due to the thinness and high magnification of the dispersion; autofluorescence is not seen in the cast cross-section sample due to its thickness and perhaps the higher proportion of drying oil in the mixture.

4.3.3. Instrumental analysis

4.3.3.1. FTIR microspectroscopy

Table 3 outlines the results of samples from the first-floor, northwest chamber analyzed by FTIR.

TABLE 3: FTIR MICROSPECTROSCOPY RESULTS – FIRST-FLOOR, NORTHWEST CHAMBER				
SAMPLE	ARCHITECTURAL ELEMENT	GENERATION	MATERIAL	FTIR IDENTIFICATION
24	closet door	first	green finish	metal pigment in drying oil
88	door architrave	first	green finish	metal pigment in drying oil

FTIR analysis of the green finish of samples 24 and 88 produces spectra that suggests the presence of a metal pigment, such as lead white, in an oil (Figures H-6a. and H-7a). Stretches related to a resinous component are not distinguishable nor do the major peaks closely match reference spectra for verdigris or copper resinate (Figures H-6b. and H-7b.).

4.3.3.2. SEM-EDS

To supplement PLM identification of copper resinate in the first generation, and to support evidence for the presence of verdigris, elemental analysis of samples 24 and 88 were performed with SEM-EDS (Figures I-4 and I-5, samples 24 and 88). The results of both elemental mapping and elemental spot analysis show the presence of lead and copper in the first-generation finish; this data supports the presence of lead white,

verdigris and/or copper resinate.

4.3.3.3. GC-MS

GC-MS analysis was performed on the first-generation green finish of sample 88 to more accurately identify the binding media and specifically to analyze for the presence of a resin component. Copper resinate is composed mainly of the copper salts of resin acids. If resins from conifers are used for the preparation of copper resinate, copper salts of abietic acid are formed as the main product; other acid components include dehydroabietic, pimaric, and isopimaric acid.⁶⁸ Detection by GC-MS of the relatively stable dehydroabietate component of resinate films is the most convincing method for identification of copper resins.⁶⁹

Unfortunately, two attempts at GC-MS analysis did not yield evidence supporting the presence of resin acids (Figure J-2, sample 88). Most peaks in the spectrum are due to Methprep II artifacts; however there are three peaks that correspond to components of linseed oil: palmitic acid, stearic acid, and azelaic acid. Under the GC conditions used, resin acid components will typically have retention times from approximately 21 to 24 minutes. The peak for dehydroabietic acid occurs at a retention time of 21.75 minutes, whereas 7-oxodehydroabietic acid – an oxidation product that is commonly found in aged resin samples – has a retention time of 23.60 minutes. The peak at 23.06 minutes cannot be identified; and the mass units for this peak are not consistent with those of a resin.

Despite the results obtained from GC-MS analysis, the obvious white autofluorescence seen under UV light in the dispersed pigment sample offers confident evidence for the

⁶⁸ Hermann Kühn. "Verdigris and Copper Resinate." *Artists' Pigments: A Handbook of Their History and Characteristics, Volume 2*, Roy, Ashok, ed. (Washington, D.C.: National Gallery of Art, 1993), 150.

⁶⁹ Ibid. 151.

presence of a resin. The resin may also be a very small component of the finish which is why it was not detected by GC-MS. The reason the autofluorescence is seen in the dispersed pigment sample is due to the thinness and high magnification of the dispersion whereas autofluorescence is not seen in the cast cross-section sample due to its thickness.

4.3.4. Color matching with colorimeter

Due to the translucent nature of the green finish and its brown discoloration, color matching was not performed, nor was color matching executed on the gray basecoat. Replication of the colors for this first-generation bright green might be more effectively achieved by hand-grinding pigments in linseed oil and resin to produce an appropriately colored base coat and bright green glaze layer.

4.3.5. Summary

The analytical data supports the characterization of the original finish of the first-floor, northwest chamber to be a copper resinate and oil mixture. As evident in cross-section photomicrographs, individual green pigment particles – most likely verdigris – are also suspended within the layer either added intentionally to provide more color or as the result of incomplete dissolution in preparation of the copper resinate. The door to the hall was possibly grained to imitate mahogany. The original finishes of the baseboards, surbase and plaster are unknown due to the lack of original building material. A summary of the first-generation finishes of the first-floor, northwest chamber are outlined in Table 4.

TABLE 4: SUMMARY OF FIRST-GENERATION FINISHES FIRST-FLOOR, NORTHWEST CHAMBER					
ARCHITECTURAL ELEMENT	FINISH	MATERIAL COMPOSITION			
		PLM	FTIR	SEM-EDS	GC-MS
panciling and woodwork	green glaze	copper resinate lead white whiting	lead white in drying oil	copper lead	linseed oil
baseboards	unknown	N/A	N/A	N/A	N/A
door to hall	dark, red-brown paint	<i>not analyzed for composition</i>	<i>not analyzed for composition</i>	<i>not analyzed for composition</i>	<i>not analyzed for composition</i>
plaster walls	unknown	N/A	N/A	N/A	N/A

4.4. Results – Drawing room

4.4.1. Cross-section microscopy

4.4.1.1. Reflected visible and ultraviolet light

The wood substrate of samples from the drawing room shows evidence of a shellac sealant within its fibers, visible in ultraviolet light as a pale orange autofluorescence (Figure F-27b, sample 47). Above the wood substrate is a white primer layer followed by a stone color finish paint (Figure F-27d., sample 47). Both layers have a strong autofluorescence in ultraviolet light.

Sample 91 was taken from the wall of the drawing room in the plaster field to the left of the blind door (and right of the chimney breast). Great care was taken to acquire the original browncoat and plaster of the wall. Coarse hair strands are seen in the browncoat of the uncast sample with examination at 30X magnification with a stereomicroscope. Above the coarse, granular brown coat is a thick layer of white, finish coat. Applied to the surface of the white coat is the plaster sealant visible as a thin translucent tannish

layer (Figure F-37, sample 91). The autofluorescence of this layer in ultraviolet light is not characteristic of limewash, as was observed on the plaster walls of the parlor. Directly above the sealant is an opaque, tannish-pink color paint that contains individual red pigment particles. There is no evidence of wallpaper fibers above the plaster sealant to indicate the possible existence of wallpaper in the first generation.

Sample 76, from the drawing room baseboard, also shows evidence of a shellac sealant within the fibers of the wood substrate. The first generation consists of a white primer, dark brown top coat, and translucent, resinous finish coat. The finish varnish coat likely consists of a plant resin due to its whitish fluorescence in ultraviolet light (Figure F-35b., sample 76).

4.4.1.2. Fluorescent stains

Fluorescent staining of sample 47 (from an area of the overmantel frame molding), suggests the presence of oil within the wood substrate; the sample shows a positive reaction to DCF for the presence of unsaturated lipids as indicated by a yellow fluorescence (Figure F-27c., sample 47).

Fluorescent staining of cross-sections did not provide conclusive information regarding the binding media of the first-generation paints. It is believed fluorescent staining reactions may be able to be observed at higher magnifications.

Sample 91 from the plaster wall was stained with TTC to test for the presence of carbohydrates. Wallpaper paste residue, usually in the form of a wheat starch paste, is a carbohydrate-based material. Staining with TTC results in a strong positive reaction seen

⁷⁰ Richard C. Wolbers. "Fluorescence Microscopy", *Analytical Techniques in Conservation* (Workshop Notes, 1996). 9.

throughout the paint layers and plaster substrate (Figure F-37c., sample 91). This pattern of staining within the cross-section matrix is not consistent with the reaction of TTC with starch paste – typically seen as a thin line below the paper surface. Instead, some other strong reducing agent is likely responsible for the strong reaction with TTC.⁷⁰

4.4.2. Polarized light microscopy

Stone color woodwork

The first-generation stone-color paint of the woodwork from sample 89 was isolated for pigment identification with polarized light microscopy. When viewed at 500X magnification, the pigment particles are white with an average particle size of approximately one micrometer (1 μm). The majority of particles have index of refraction higher than 1.66. The particles also have a positive, high relief meaning the particles' index of refraction differs from the mounting medium by 0.12 or more ($n_{\text{particle}} > 1.78$). With crossed polars, some particles are visible indicating the presence of anisotropic, birefringent particles. Both isotropic and anisotropic particles are seen simultaneously at slightly crossed polars (20°). The white particles are highly birefracting. These properties indicate pigment identifications of lead white with a small amount of whiting.

Additional pigments are observed in the dispersions but only at an extremely low concentration. Anisotropic red and orange particles are observed that have a refractive index greater than 1.66; this classifies the particles in the iron oxide category, with a specific identification as red ochre. Multiple sampling of the stone-colored paint was required to obtain a dispersion with a definitive amount of red ochre particles. This suggests that the paints were extremely finely ground and the pigments well dispersed throughout the paint; this then indicates a high level of craft of those preparing the paints.

Dark brown baseboards

PLM of the first-generation, dark brown paint of the drawing room baseboard was not performed yet analysis was completed for the first-generation baseboard paint of the parlor. It is believed that the baseboard paint of the parlor is representative of the baseboard paint of the drawing room. See section 4.2.2 for PLM results of the parlor baseboard paint.

Tannish-pink plaster fields

Lead white, whiting and red ochre are identified in the pigment dispersion of the first-generation tannish-pink paint of the drawing room plaster fields (sample 91). Small black particles are observed in cross-section photomicrographs of sample 91 yet they are not isolated in the pigment dispersion; it is possible this black pigment is carbon black.

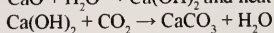
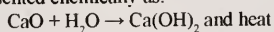
4.4.3. Instrumental analysis

4.4.3.1. FTIR microspectroscopy

Table 5 outlines the results of samples from the drawing room analyzed by FTIR.

TABLE 5: FTIR MICROSPECTROSCOPY RESULTS—DRAWING ROOM				
SAMPLE	ARCHITECTURAL ELEMENT	GENERATION	MATERIAL	FTIR IDENTIFICATION
89	door architrave	first	paint; stone color	lead white in drying oil
91	wall plaster	first	paint; tannish-pink color	lead white in drying oil
			plaster sealant; tannish color	calcite hydrocarbon component
		substrate	plaster surface; white	calcite oil

⁷¹ The lime cycle involves slaking quicklime (CaO) with water to produce hydrated lime (Ca(OH)₂, applied to the walls in this form). Carbonation of the hydrated lime on exposure to air then forms the lime plaster. These reactions are represented chemically as:



FTIR analysis of the first-generation paint of the woodwork (sample 89) and the first-generation paint above the plaster (sample 91) produce spectra indicative of an oil medium with metal drier (Figures H-8 and H-9a.).

Analysis of material scraped from the surface of the plaster substrate indicates the major composition to be calcite (lime, calcium carbonate) (Figure H-9b., sample 91). A minor amount of oil is evidenced with hydrocarbon (C-H) stretches at 2925 and 2854cm^{-1} ; the oil has likely been absorbed into the plaster to a small degree from the paint layer above. Strong antisymmetric and symmetric hydroxyl (O-H) stretches occur at 3691 and 3643cm^{-1} and are possibly due to the presence of slaked lime ($\text{Ca}(\text{OH})_2$) which has not completely carbonated to form calcium carbonate (CaCO_3).⁷¹

Sampling the sealant produces a unique FTIR spectrum (Figure H-9c.). As previously described, staining of the cross-section with TTC for the presence of carbohydrates yielded a strong positive reaction. However, the FTIR spectrum does not have strong peaks characteristic of a carbohydrate composition; carbohydrates have strong, broad bands at about 1080cm^{-1} due to carbon-oxygen stretching as well as strong bands at about 3300cm^{-1} due to hydroxyl groups. The strong staining reaction of TTC is instead likely due to the presence of some other reducing compound rather than a carbohydrate.⁷²

The strongest peak of the spectrum is carbonate stretching from calcite which could have been accidentally sampled from the plaster substrate. While the remaining peaks do not easily match available reference spectra, the peak at 1380cm^{-1} suggests the possible presence of a nitrate component. The stretches between 3500 and 3200cm^{-1} are characteristic of water of hydration and the carbon-hydrogen stretches between 3000 and

⁷² The sealant layer, as seen in cross-section, is the one area where the positive red-brown staining color does not occur. Instead, this layer retains a bluish-white autofluorescence.

2800cm⁻¹ are characteristic of a low-boiling hydrocarbon.

It was hoped that the composition of the plaster sealant could be identified by FTIR; however, isolation of this layer proved difficult, in part because it is so thin and so translucent it is difficult to confidently acquire a sample. Therefore characterization was not feasible; one possibility is that a clearcoat type of sealant was used.

FTIR analysis of the first-generation, dark brown paint of the drawing room baseboard was not performed yet analysis was completed for the first-generation baseboard paint of the parlor. It is believed that the baseboard paint of the parlor is representative of the baseboard paint of the drawing room. See section B.3.a. sample 85 for FTIR results of the parlor baseboard paint.

4.4.3.2. SEM-EDS

Sample 91 was analyzed with SEM-EDS to understand the elemental composition of the plaster substrate and first-generation paint. Despite the carbon coating achieved for sample preparation, analysis was not successful due to excessive charging on the cross-section surface (Figure I-6b.). When the sample was removed from the SEM chamber after analysis, a coating appears to have seeped out of the cross-section and been deposited on the sample surface, thus disrupting the carbon film. It is possible that the carbon coating applied to the sample was too thin and therefore did not dissipate the intense energy of the electron beam. As a result, the energy of the beam caused the sample to vaporize or burn.

4.4.3.3. GC-MS

Samples from the drawing room were not analyzed by GC-MS.

4.4.4. Color matching with colorimeter

Sample 50 – door to stairhall, stile

First-generation paint

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 3.5Y	V (value) 7.3	C (chroma) 2.2
CIE L*a*b*	L* (black to white) 73.63	a* (green to red) -0.53	b* (blue to yellow) +15.31

Benjamin Moore® Color Preview™ HC-82 “bennington gray”

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 3.8Y	V (value) 7.2	C (chroma) 2.2
CIE L*a*b*	L* (black to white) 72.75	a* (green to red) -0.72	b* (blue to yellow) +15.48

NOTE: Color match is not provided due to lack of printer calibration for color rendering.

The ΔE value for the color difference between the first-generation paint layer of Corbit-Sharp House drawing room sample 50 and the best commercial match, Benjamin Moore® Color Preview™ HC-82 “bennington gray”, is $\Delta E = 0.92$. The commercial color swatch is an excellent numeric as well as visual match.

Sample 91 – plaster field

First-generation paint

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 7.8YR	V (value) 6.9	C (chroma) 2.0
CIE L*a*b*	L* (black to white) 69.51	a* (green to red) +3.93	b* (blue to yellow) +12.21

Sherwin Williams® COLOR™ SW 6066 “Sand Trap”

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 7.3YR	V (value) 6.8	C (chroma) 1.9
CIE L*a*b*	L* (black to white) 69.20	a* (green to red) +4.06	b* (blue to yellow) +11.43

NOTE: Color match is not provided due to lack of printer calibration for color rendering.

The ΔE value for the color difference between the first-generation paint layer of Corbit-Sharp House drawing room sample 91 and the best commercial match, Sherwin Williams® COLOR™ SW 6066 “Sand Trap”, is $\Delta E = 0.85$. The commercial color swatch is an excellent numeric as well as visual match.

The best commercial match for the baseboard paint of the drawing room is Benjamin Moore® Color Preview™ 2113-10 “chocolate sundae” with a ΔE of 3.12. See section 4.2.4 for the reference swatch for this color.

4.4.5 Summary

The original color scheme of the drawing room consisted of stone colored woodwork, tannish-pink colored plaster fields and dark brown baseboards. The doors were originally painted the same stone color as the woodwork. A summary of the first-generation finishes of the drawing room are outlined in Table 6.

TABLE 6: SUMMARY OF FIRST-GENERATION FINISHES DRAWING ROOM				
ARCHITECTURAL ELEMENT	FINISH	MATERIAL COMPOSITION		
		PLM	FTIR	SEM-EDS
paneling, woodwork and doors	stone color paint	lead white whiting red ochre	lead white in drying oil	<i>not analyzed for composition</i>
baseboards	dark brown color paint	<i>not analyzed for composition</i> ⁷³	<i>not analyzed for composition</i> ⁷⁴	<i>not analyzed for composition</i> ⁷⁵
plaster walls	tannish-pink paint	lead white whiting red ochre	metal drier in drying oil	<i>not analyzed for composition</i>

⁷³ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the drawing room; red ochre is major pigment identified by PLM of the baseboard paint.

⁷⁴ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the drawing room; the composition of the baseboard paint as analyzed by FTIR is a metal drier in a drying oil.

⁷⁵ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the drawing room; elements present in the first-generation dark brown paint are iron, calcium and silicon.

4.5. Results – Second-floor, southeast chamber

4.5.1. Cross-section microscopy

4.5.1.1. Reflected visible and ultraviolet light

Sample 82, from the baseboard, is the only cross-section of all samples from throughout the house that shows evidence of the use of possible iron oxide red pigment within the primer layer applied directly to the wood substrate (Figure F-47b.). This is not sufficient data to suggest the application of a red iron oxide primer – what was often used the eighteenth century. The amount of red pigment evident in the layer is minimal and thus its presence is possibly the result of contamination from the paint mixing and application process. The wood substrate also shows evidence of a shellac sealant within its fibers, discernible in ultraviolet light as a pale orange autofluorescence.

Above the wood substrate is a white primer layer followed by a stone color finish paint (Figures F-42 and F-43, samples 81 and 90). Both layers have a strong autofluorescence in ultraviolet light.

Sample 104 was taken from the plaster wall (Figures F-52 and F-53). Careful attention was made to acquire the original browncoat and plaster of the wall. Coarse hair strands are seen in the browncoat of the uncast sample with examination at 30X magnification with a stereomicroscope. Above the coarse, granular brown coat is a thick layer of white plaster finish coat. The plaster sealant is visible on the surface of the plaster finish coat as a thin translucent, tannish layer. The autofluorescence of this layer in ultraviolet light is not characteristic of limewash, as was observed on the plaster walls of the parlor; instead, the sealant could be a clearcole treatment. The surface of the sealant appears disrupted in some areas to suggest that it was perhaps mechanically scraped or sanded at some point. Above the sealant is a white paint layer. The texture of the white paint is not

consistent with eighteenth-century paints and its slight sparkly appearance in ultraviolet light suggests the paint media to be an emulsion paint (a typical composition of mid- to late-eighteenth century paints).⁷⁶ Thus, the cross-section photomicrograph of sample 104 suggests that the plaster and sealant is original, eighteenth-century material but the finish coat above the sealant is not. Furthermore, there is no evidence of wallpaper fibers above the plaster sealant to indicate the possible existence of wallpaper in the first generation.

Sample 55 from the baseboard indicates the first generation consisted of a white primer, dark brown top coat and translucent, resinous finish coat. The finish varnish coat likely consists of a plant resin due to its whitish fluorescence in ultraviolet light (Figure F-49b., sample 55).

4.5.1.2. Fluorescent stains

Fluorescent staining of sample 90, from the door to the drawing room, suggests the presence of oil within the wood substrate; the sample shows a positive reaction to DCF for the presence of unsaturated lipids as indicated by a yellow fluorescence (Figure F-43c.). Faint red positive staining for the presence of saturated lipids is seen in the primer layer. Reaction to fluorescent staining of the first-generation finish coat is not observed likely due to the high pigment to binder ratio.

Sample 104 from the plaster wall was stained with TTC to test for the presence of carbohydrates (Figure F-52e.). Wallpaper paste residue, usually in the form of a wheat starch paste, is a carbohydrate-based material. In cross-sections where wallpaper is known to have existed, the positive deep red reaction color for the presence of starch paste is usually seen as a thin line below the paper surface. Starch paste that penetrates

⁷⁶ Susan L. Buck. Personal communication, June 2003.

cracks within the substrate or earlier finish layers will also produce a red reaction when exposed to TTC. While positive reactions for the presence of carbohydrates are apparent in the cross-section, the pattern of staining does not provide compelling evidence for the presence of wall paper paste above the limewash. This analysis does not definitively conclude that the walls of the parlor were not wallpapered in the first generation. One can only say that conclusive evidence of a wallpaper treatment was not found in the sample analyzed.

Sample 104 was stained with TSQ to test for the presence of zinc. A positive reaction is seen in the first-generation, white paint layer as a bluish, sparkly appearance (Figure F-52f.). This suggests the presence of zinc but is not considered to be a conclusive identification. Zinc may be present as zinc white (ZnO) which would indicate an application date post 1834.

4.5.2. Polarized light microscopy

Stone color woodwork

The first-generation stone-color paint of the woodwork from sample 90 was isolated for pigment identification with polarized light microscopy. Examination of the pigment particles yields the identification of lead white, whiting and red ochre – the same pigments identified in the stone color paints of the parlor and drawing room.

White paint of plaster walls

Zinc white particles are identified in the dispersed pigment sample of the first-generation paint from the plaster wall, sample 104. The particles closely match a reference dispersion of zinc white; the particles have an index of refraction greater than 1.66 and are only lightly birefracting. The presence of zinc white is supported with a bright yellow

fluorescence of the particles as viewed under ultraviolet light.⁷⁷ The presence of zinc white dates the application of the paint to post-1834; therefore, the paint was not present during William Corbit's lifetime (1746-1818). Whiting is also identified in the pigment dispersion.

Dark brown baseboard

PLM of the first-generation, dark brown paint of the second-floor, southeast chamber baseboard was not performed yet analysis was completed for the first-generation baseboard paint of the parlor. It is believed that the baseboard paint of the parlor is representative of the baseboard paint of the second-floor, southeast chamber. See section 4.2.2 for PLM results of the parlor baseboard paint.

4.5.3. Instrumental analysis

4.5.3.1. FTIR microspectroscopy

Table 7 outlines the results of samples from the second-floor, southeast chamber analyzed by FTIR.

TABLE 7: FTIR MICROSPECTROSCOPY RESULTS – SECOND-FLOOR, SOUTHEAST CHAMBER				
SAMPLE	ARCHITECTURAL ELEMENT	GENERATION	MATERIAL	FTIR IDENTIFICATION
56	surbase	second	paint; green color	lead white in drying oil Prussian blue kaolinite quartz
90	door	first	paint; stone color	lead white in drying oil

The FTIR spectrum of the first-generation stone color paint of the second-floor, southeast

⁷⁷ Rutherford J. Gettens and George L. Stout, *Painting Materials: A Short Encyclopedia*, (New York: Dover Publications, Inc., 1966), 177.

chamber is characteristic of lead white in a drying oil (Figure H-10, sample 90).

The second-generation paint of surbase sample 56 was analyzed for interest. FTIR spectra suggest the major component of the sample to be a metal drier in a drying oil; other components include Prussian blue, clay and quartz (Figure H-11a., H-11b., sample 56). The pigment Prussian blue ($\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$) is evident with the characteristic $[\text{Fe}(\text{C}\equiv\text{N})_6]^{3-}$ ion stretching band at 2086cm^{-1} . Clay, or some general hydrated aluminum silicate ($\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$), is apparent with slight O-H stretching bands at 3700 and 3622cm^{-1} , asymmetric Si-O-Si stretching bands from 1100 to 1000cm^{-1} , and an Si-O stretching band at 914cm^{-1} . Quartz (silicon dioxide, SiO_2) is evident by characteristic, weak doublet stretches at 794 and 779cm^{-1} ; quartz would also contribute to asymmetric Si-O-Si stretching bands from 1100 to 1000cm^{-1} .

FTIR analysis of the first-generation, dark brown paint of the second-floor, southeast chamber baseboard was not performed yet analysis was completed for the first-generation baseboard paint of the parlor. It is believed that the baseboard paint of the parlor is representative of the baseboard paint of the second-floor, southeast chamber. See section B.3.a. sample 85 for FTIR results of the parlor baseboard paint.

4.5.3.2. SEM-EDS

Samples from the second-floor, southeast chamber were not analyzed by SEM-EDS.

4.5.3.3. GC-MS

Samples from the second-floor, southeast chamber were not analyzed by GC-MS.

4.5.4. Color matching with colorimeter

Sample 90 – door to drawing room

First-generation paint

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 6.4Y	V (value) 7.0	C (chroma) 2.7
CIE L*a*b*	L* (black to white) 70.95	a* (green to red) -3.11	b* (blue to yellow) +19.58

Benjamin Moore® Color Preview™ HC-91 “danville tan”

COLOR SYSTEM		COORDINATES	
Munsell H V/C	H (hue) 4.2Y	V (value) 6.9	C (chroma) 2.8
CIE L*a*b*	L* (black to white) 69.72	a* (green to red) -1.04	b* (blue to yellow) +19.71

NOTE: Color match is not provided due to lack of printer calibration for color rendering.

The ΔE value for the color difference between the first-generation paint layer of Corbit-Sharp House second-floor, southeast chamber sample 90 and the best commercial match, Benjamin Moore® Color Preview™ HC-91 “danville tan”, is $\Delta E = 2.41$. The commercial color swatch is a good numeric as well as visual match.

The best commercial match for the baseboard paint of the drawing room is Benjamin Moore® Color Preview™ 2113-10 “chocolate sundae” with a ΔE of 4.39. See section 4.2.4 for the reference swatch for this color.

4.5.5 Summary

The original color scheme of the second-floor, southeast chamber consisted of stone colored woodwork and dark brown baseboards. The doors were originally painted the same stone color as the woodwork. The original finish of the eighteenth-century plaster walls was not present in the sample acquired; further work is necessary to sample and identify plaster with the original finish. A summary of the first-generation finishes of the drawing room are outlined in Table 8.

TABLE 8: SUMMARY OF FIRST-GENERATION FINISHES SECOND-FLOOR, SOUTHEAST CHAMBER				
ARCHITECTURAL ELEMENT	FINISH	MATERIAL COMPOSITION		
		PLM	FTIR	SEM-EDS
panelling, woodwork and doors	stone color paint	lead white whiting red ochre	lead white in drying oil	<i>not analyzed for composition</i>
baseboards	dark brown color paint	<i>not analyzed for composition</i> ⁷⁸	<i>not analyzed for composition</i> ⁷⁹	<i>not analyzed for composition</i> ⁸⁰
plaster walls	unknown	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>

⁷⁸ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the second-floor, southeast chamber; red ochre is major pigment identified by PLM of the baseboard paint.

⁷⁹ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the second-floor, southeast chamber; the composition of the baseboard paint as analyzed by FTIR is a metal drier in a drying oil.

⁸⁰ See Table 2. The baseboard paint of the parlor is thought to be representative of that of the second-floor, southeast chamber; the elemental composition of the baseboard paint as analyzed by SEM-EDS is iron, lead, calcium, silicon and copper.

CHAPTER 5

INTERPRETATION OF FINISHES

The technical analysis of the finishes in four key rooms provides new information about the composition of the first-generation finishes in the Corbit-Sharp House. It also gives unusual insight into eighteenth-century painting practices in a small Delaware town. Based on the colors of the original finishes, the study contributes to an understanding of the deliberate choices made by William Corbit for the interior palette of his country mansion and enhances the greater body of research aimed at understanding the appearance and room use of eighteenth-century interiors. Finally, the analysis offers the opportunity for paint archaeology, to approximately date individual layers and to distinguish between original and added elements, especially in a building such as the Corbit-Sharp House where rooms have been altered over time.

In the wood trim samples taken for this study, the wood substrate consistently has evidence of a shellac sealant trapped in its fibers – identifiable in ultraviolet light as a pale orange autofluorescence. Cross-section staining also indicates the presence of oil within the fibers of the wood substrate. The significance of this treatment is that it reveals that the wood was well-sealed with shellac and oil prior to painting. Eighteenth-century recipe books often suggest the application of two or three primer coats and one or two finish coats to adequately coat the surface.⁸¹ This is evidently *not* how the Corbit House woodwork was treated. Instead, the use of oil and shellac to pre-treat the wood meant the application of multiple primer and finish coats was not necessary. Evidence for the use of shellac as a sealant has been characterized by fluorescence microscopy in cross-section examination of wood substrate samples from other eighteenth-century buildings, yet a

⁸¹ Ian Bristow, "House Painting in Britain," *Paint in America: The Colors of Historic Buildings*, Roger W. Moss, ed. (New York: John Wiley & Sons, Inc., 1994), 49.

period reference for this treatment has not yet been found.⁸² Identification of shellac has yet to be confirmed by other analytical methods.

Based on the combined methods of analysis, it was determined that the compositions of the first-generation paints were of notably high quality. For the stone color paints of the parlor, drawing room and second floor, southeast chamber, the paints were found to contain mostly lead white, an opaque and relatively expensive white pigment. The strong hiding power of lead white would also explain the lack of multiple primer and finish coats. Neither iron nor calcium is detected in the first-generation paint with SEM-EDS, even with spot analysis, although the presence of red ochre (Fe_2O_3) and whiting (CaCO_3) was identified by PLM. This suggests that the whiting (a cheap extender) and colored pigment red ochre are present at a very low concentration and is well dispersed though the paint. A formula for a 'dark stone color' is given by Hezekiah Reynolds in *Directions for House and Ship Painting* (1812) contained six pounds of lead white, eight ounces of yellow ochre, and $\frac{1}{2}$ gill of lamp black.⁸³ Black pigment particles were not identified with PLM analysis of the stone color paints of the Corbit House yet were intermittently observed in uncast paint samples with the aid of the stereomicroscope. The small ratio of lead white to ochre and lamp black listed in Reynolds' period recipe may help to explain the analytical results of SEM-EDS and PLM.

Exact color identification is a problematic aspect of architectural finishes research. Good color matching depends on an adequate and representative sample. However, the nature

⁸² Susan L. Buck, "The Benjamin Waller House: Interior Woodwork Cross-Section Microscopy Report," unpublished report, Historic Paint and Architectural Services (1999); Susan Buck, "Tudor Place: Interior Paint Study Cross-Section Microscopy Report," unpublished report, Historic Paint and Architectural Services (2002); Susan Buck, personal communication, June 2003; Catherine Matsen, "Cross-Section Microscopy Report: Architectural Fragments Collection," unpublished report, Colonial Williamsburg Foundation (2002); Catherine Matsen, "Cross-Section Microscopy Report: Shirley Plantation," unpublished report, Colonial Williamsburg Foundation (2002).

⁸³ A gill is equal to five fluid ounces in British Imperial measure.

of hand-ground paints is such that particle dispersion is not necessarily uniform and therefore slight differences in color can occur within a single batch of paint and especially between batches. Even with the best samples for color matching, paint discoloration is inevitable, not easily measurable and thus complicates the original color identification of architectural paints. The unstable nature of oil paint media causes them to darken to a yellow-brown color when placed in darkness (either located behind an object or covered over with another finish layer) and causes a blanching affect when exposed to light. Blanching results in a reduction of glossiness and faded appearance. In addition to media deterioration, fugitive pigments present in a paint layer may cause discoloration. The degree of discoloration that occurs with historic paints is not measurable and therefore color matching is never exact. There are some commonly practiced procedures employed to compensate for the discoloration of oil paint but these were not carried out for this analysis because the additional variables of excessive bleaching of the media, possible degradation of pigments, and the accelerated aging caused by the typical light-bleaching methods. Future research could include controlled light bleaching with frequent color measurements to assess and document any changes that take place over time. Identification of the pigments in the first-generation paints of the Corbit-Sharp House shows that they are all stable and non-fugitive.

Despite the precision and sophistication of color matching as practiced with a colorimeter, the best commercial matches provide only one aspect of visual quality of the paints. They by no means accurately represent the eighteenth-century appearance in terms of gloss and texture of the paints as applied in the rooms. However, the color matches are extremely useful in understanding the color palette used throughout the house. The color of finishes is only one aspect of interior decoration to be considered and must be incorporated with research as to the furnishings, fabrics, and wall and floor treatments of a room.

5.1 Parlor

An important aspect to consider when investigating and interpreting eighteenth-century interiors is the use of wallpaper. Research of Georgian house interiors suggests there are relationships between the paint colors applied to woodwork and the treatment of plaster walls. Rooms with woodwork painted pale ochre, stone, and off-white colors were frequently combined with wallpaper during the second half of the eighteenth century. Conversely, rooms with strong and vivid paint colors on the trim were often not accompanied with wallpaper.⁸⁴

The original color of the parlor woodwork was matched to a stone color, yet no evidence of wallpaper was found to exist on the plaster walls. This analysis does not definitively conclude that the walls of the parlor were not wallpapered in the first generation. It can only be said that conclusive evidence of a wallpaper treatment was not found in the samples analyzed. Certainly William Corbit had the sophistication, wealth, and means to acquire fashionable wallpaper of the period. More importantly, the lack of evidence for wallpaper in the parlor does not change its interpretation as a space for public reception and entertainment.

According to research of eighteenth-century wallpaper in America, Plunket Fleeson, a Philadelphia upholsterer, first announced in 1769 that he had for sale “American Paper Hangings...manufactured in Philadelphia...not inferior to those generally imported”.⁸⁵ Although documentation is scarce, imported wallpaper, both plain and patterned, was available in Philadelphia and other major port cities prior to this date and had probably

⁸⁴ Margaret Beck Pritchard and Willie Graham, “Rethinking Two Houses at Colonial Williamsburg”, *Antiques Magazine* (January 1996), 168.

⁸⁵ Catherine Lynn. *Wallpaper in America: From the Seventeenth Century to World War I* (New York: W.W.Norton & Company, 1980), 107.

come into moderate use by the 1740s.⁸⁶ Imported paper hangings were first advertised in the colonies in 1737 and domestic manufacture was begun prior to 1763.⁸⁷ In a 1767 letter Benjamin Franklin writes to his wife Deborah about their home in Philadelphia:

“I suppose the blue Room is too blue, the Wood being of the same colour w/the Paper and looks too dark. I would have you finish it as soon as you can, thus. Paint the Wainscot a dead white; Paper the Walls blue, & tack the Gilt Border round just above the Surbase and under the Cornish. If the Paper is not equal Coloured when pasted on, let it be brush’d over again w/the same colour: and let the Papier machée musical Figures be tack’d to the middle of the Cieling; when this is done, I think it will look very well.”⁸⁸

In Philadelphia and elsewhere in the colonies, plain colored wallpapers were an alternative to painted plaster walls and blue seems to have been the most popular choice of American customers.⁸⁹ Although evidence of wallpaper was not found in this analysis, it is a distinct possibility that William Corbit papered the parlor given the vogue for wallpaper treatments among the colony’s elite after the mid-eighteenth century. Research into the basis of a Quaker “domestic interior” has received minimal scholarship; further investigation, both in theory and in practice, is necessary to better understand this aspect of the socio-historical study of the sect.⁹⁰

⁸⁶ Horace L. Hotchkiss, Jr., “Wallpaper from the Shop of William Poyntell,” *Winterthur Portfolio*, Volume 4 (1968), 33.

⁸⁷ Teresa Green, “The Birth of the American Paint Industry.” M.A. thesis, University of Delaware (1965), 36.

⁸⁸ Letter to Deborah Franklin, date London, June 22, 1767; quoted in Edward M. Riley, “Franklin’s Home,” *Historic Philadelphia: From the Founding until the Early Nineteenth Century* (Philadelphia: American Philosophical Society, 1953), 154.

⁸⁹ Catherine Lynn, *Wallpaper in America: From the Seventeenth Century to World War I* (New York: W.W.Norton & Company, 1980), 148.

⁹⁰ Previous theses relating to this subject include Sara Margaret Pennell’s “The Quaker Domestic Interior, Philadelphia 1780-1830: An Artifactual Investigation of the ‘Quaker Esthetic’ at Wyck House, Philadelphia and Collen Brook Farm, Upper Darby, Pennsylvania,” Master of Science thesis, University of Pennsylvania, 1992, and Susan L. Garfinkel’s “Discipline, Discourse and Deviation: the Material Life of Philadelphia Quakers, 1762-1781,” Master of Arts thesis, University of Delaware, 1986.

Samples from the parlor door clearly show the presence of a graining sequence in the first generation, likely painted to imitate mahogany. This was an extremely fashionable, high-style treatment in the eighteenth century that would have elevated the decorative sophistication of the room. The analysis did not reveal evidence of an eighteenth-century finish on the plaster walls. Applied to the original plaster finish coat is a layer of limewash and directly above this is an off-white paint layer that contains zinc white, a pigment that was only commercially available after 1834.

5.2 First-floor, northwest chamber

As tends to be the case with eighteenth-century gentry houses, the architecture reflects room hierarchy and function.⁹¹ The architectural elements of the Corbit-Sharp House parlor, designed to be an impressive public space, include a broken pediment above a crossetted door architrave, a fireplace mantel, cornice with dentil molding and raised panel wainscoting extending around the room. In addition, the crossetted feature of the door architrave is repeated in the window architraves, overmantel frame and fireplace opening. The original architectural woodwork of the first-floor, northwest chamber, on the other hand, includes a comparatively plain door architrave.⁹² The neat and plain appointment of the back chamber would imply its use as a secondary space compared to

⁹¹ Edward A. Chappell, "Looking at Buildings," *Fresh Advice: A Research Supplement to the Colonial Williamsburg Interpreter* 5 (1984), i-vi.

⁹² Most of the woodwork in the northeast chamber is reconstructed from the 1938-1942 restoration; the only original woodwork is the door, door architrave and right closet door. Lindsey writes, "Originally the cornice extended only across the paneled end. It was decided, however, to extend it around the entire room. Old cornice was salvaged from an old house being razed in Philadelphia, and after cleaning off the paint and repairing the fret, was erected." The original paneling of the first-floor, northwest chamber, with the exception of the overmantel, was removed in the nineteenth century; a photograph of the fireplace circa 1932 shows the original raised-panel overmantel (Figure A-2). It is not clear from Lindsey's restoration account whether the original overmantel was included in the restored paneling of the east wall. On-site examination with a 30X hand-held monocular microscope of most areas of the paneling indicates it is restoration-era woodwork because there are no early paint generations. Low areas of the overmantel did not reveal the presence of early paint generations perhaps because these areas were mechanically scraped during the restoration. If the overmantel is original, examination with a ladder of higher areas may yield evidence of first-generation paint.

the parlor.

The first-generation presentation surface of this chamber was composed of a copper resinate glaze with verdigris pigment particles within. This was considered a costly finish not only due to the expense of verdigris but also because the preparation and application of the copper resinate and/or verdigris finish would have required the skill of an experienced painter. A period recipe for the composition of a verdigris glaze is provided as:

8oz French verdigris
1/2oz Sugar of Lead
4oz Linseed oil
Grind these very fine and add 4oz white paint ground in oil
4oz Spirits of Turpentine
6oz Turpentine varnish⁹³

A treatment of this kind would have been a deliberate demonstration of Corbit's wealth. The use of such materials is significant to the interpretation of the room and its function and provides greater understanding of William Corbit and his tastes. While the 1978 paint analysis of the first-floor chamber attributed a dark green color paint as the first-generation finish, it did not characterize the finish as a copper resinate glaze and did not identify verdigris pigment particles.

It is obvious that the architecture of the Corbit House is related in form and plan to important Philadelphia houses of the period; yet it is not completely understood to what extent Corbit's choices of interior finishes were also influenced by Philadelphia practices. The only physical evidence of verdigris found by paint analyst Frank S. Welsh

⁹³ Timothy Fishwick, *MISCELLANEA CURIOSA or a Memorandum of Many Useful Receipts*, 1795-1816. Transcribed by Christopher Ohrstrom, Victoria and Albert Museum 86.HH.75.

in an eighteenth-century Philadelphia building is from the Senate Chamber of Congress Hall, Independence Square Buildings. As explained in his 1995 report, Welsh sampled finishes from original architectural elements from this room.⁹⁴ The first-generation finish of the plaster dado (circa 1793-1795) is described as a strong green, low-gloss, oil-based paint with the pigments verdigris, white lead, calcium carbonate and minor amounts of yellow ochre and red iron oxide.⁹⁵ Welsh's paint analysis and documentary research of eighteenth-century Philadelphia-area residences, such as the country seats along the Schuylkill River, has not yet yielded solid evidence of the use of verdigris based paints and glazes.

In New Castle, Delaware, a verdigris-based paint was discovered on plaster walls of the George Read II House, built between 1797 and 1804. Paint analyst Matthew Mosca determined the original finish of the plaster walls in the back chamber to be finished with a lime casein paint of whiting and verdigris.⁹⁶ Mosca matches the color of the flat, green distemper finish to Munsell chip 10G 7/4. It must be stressed, however, that the dates attributed to the Senate Chamber plaster dado and the period of construction of the George Read II House are much later than the Corbit-Sharp House. In addition, the descriptions of the verdigris-based finishes applied to the plaster walls are apparently a different treatment than that found on the Corbit-Sharp House woodwork.

Documentation from General John Cadwalader's Philadelphia mansion suggests the possible use of verdigris paint. The house, once located on Second Street, was built in 1760 by Samuel Rhoads. It was later purchased by General John Cadwalader who made

⁹⁴ The original architectural elements from the room exist as fragments. They are accessioned museum objects with the Independence National Historic Park.

⁹⁵ Frank S. Welsh. "Comparative Microscopical Paint & Color Analysis: Independence Square Buildings, Congress Hall," (January 27, 1995). 5.

⁹⁶ Matthew J. Mosca, "Historic Paint Analysis Report: George Read II House," unpublished report (September 15, 1981), 29.

major alterations and improvements to the house beginning in 1770. The plain interior appointments were replaced with elaborate woodwork, carvings and plasterwork. With the redecorating came the application of new paint; a document recording the work done by painter Anthony de Normandie for General John Cadwalader in 1771 amounted to:

134 yards green	88 yards of mahogany
1,053 ½ ditto 3 times done	216 ditto blue walls & ceiling finished
813 do twice done	124 do yellow do
265 ⅔ do once done	39 do once done blue do
	64 ½ do lead color do ⁹⁷

Other evidence suggests that the blue color was used in the large, front parlor and the yellow in the back parlor. Due to the large amount of green listed in the bill, it is assumed that the green paint was applied in the upper floors.⁹⁸ Though it cannot be confirmed, it is possible that verdigris was the green pigment used for this paint.

Further research and paint analysis is therefore needed to understand the extent of verdigris-based finishes specifically in colonial Philadelphia; therefore, the broader body of research of colonial interiors serves to understand the context of finishes in the Corbit-Sharp House. Verdigris treatments were extremely popular during the eighteenth century and have been found in other colonial era gentry houses such as George Washington's Mount Vernon (1775, redecorated 1785); Thomas Jefferson's Monticello (c. 1770-1782); the Benjamin Waller House (c. 1749), the Brush-Everard House (c. 1755), and the James Geddy House (c. 1760s) in Williamsburg, Virginia; and the Hart-Choate House (c. 1757-

⁹⁷ Bill (Historical Society of Pennsylvania) reproduced in Nicholas B. Wainwright, *Colonial Grandeur in Philadelphia: The House and Furniture of General John Cadwalader* (Philadelphia: The Historical Society of Pennsylvania, 1964), 30.

⁹⁸ Nicholas B. Wainwright, *Colonial Grandeur in Philadelphia: The House and Furniture of General John Cadwalader* (Philadelphia: The Historical Society of Pennsylvania, 1964), 30.

1761) from Ipswich, Massachusetts.⁹⁹

The *Gunston Hall Room Use Study* provides the most compelling indication for the original function of the first-floor, northwest chamber of the Corbit-Sharp House.

Gunston Hall (1759), located in Mason Neck, Virginia, was built by George Mason (1725-1792), a successful planter, political figure and author of the Virginia Declaration of Rights. Paint analysis completed by Frank S. Welsh revealed the application of a verdigris glaze as the second-generation finish of the first-floor chamber. The application date of this finish layer is uncertain yet it is known that the redecoration occurred later in George Mason's lifetime; it is possible the repainting coincided with Mason's second marriage in 1780.¹⁰⁰

Records of Gunston Hall clearly indicate the role of the first-floor chamber – located just off the front passage – as command central for the mistress of the house. The *Gunston Hall Room Use Study* explains how the centrally located room played a vital role in the domestic management of the Mason's large plantation as well as the management of the household. It served as a combination bed chamber, dressing room, work room and place to socialize with family members and intimate friends. The *Room Use Study* also notes:

⁹⁹ See Susan L. Buck, "Mount Vernon: Small Dining Room Paint Analysis," unpublished report, Historic Paint and Architectural Services (2000), 40; Susan L. Buck, "The Benjamin Waller House: Interior Woodwork Cross-section Microscopy Report," unpublished report, Historic Paint and Architectural Services (1999), 4; Susan L. Buck, "The Hart-Choate House: Cross-section Microscopy Report," unpublished report, Historic Paint and Architectural Services (2000), 62; Margaret Beck Pritchard and Willie Graham, "Rethinking Two Houses at Colonial Williamsburg", *Antiques Magazine* (January 1996), 168; Willie Graham, personal communication, June 2003.

¹⁰⁰ *Gunston Hall Room Use Study*, <http://www.gunstonhall.org/architecture/roomuse/clues.html> (April 26, 2003).

“...as the idea of the nuclear family became increasingly strong throughout the century and the mother’s role became more concerned with raising and educating her children, the Chamber would have been an important focus of mother/child relationships.”¹⁰¹

Further clues that suggest the function of the room as command central for the management of the household are the two large, deep closets on either side of the chimney. Records of the house indicate that the right closet contained Ann Mason’s wardrobe while the other closet held “smaller or more precious stores for the Table”.¹⁰² Research suggests that “smaller stores seem to include tea and tea containers, sugar and sugar containers, pepper boxes, butter pots, mustard pots, spice boxes and/or spices, and “physicks” or medicines.¹⁰³ The room thus served as a distribution point for goods whose quantities needed to be tracked by the mistress.

As at Gunston Hall, the first-floor chamber of the Corbit-Sharp House has two closets equipped with locks and it was the mistress of the house who held the keys to such closets where valuables were stored.¹⁰⁴ The first-floor chamber of the Corbit-Sharp House is also centrally located. The room has direct access to the front passage and is nearest the back door of the house; this position would have allowed the mistress to keep track of the comings and goings of household members. In addition, the first-floor chamber has convenient access to the stairs leading to the original basement kitchen, as the first-floor chamber is likely the room where the family would take its meals.

¹⁰¹ *Gunston Hall Room Use Study*, <http://www.gunstonhall.org/architecture/roomuse/domesticspaces.html> (April 26, 2003).

¹⁰² *Ibid.*

¹⁰³ *Ibid.*

¹⁰⁴ The inner configurations of the first-floor chamber closets of the Corbit-Sharp House are not true to the original. Restoration carpenter H.L. Lindsey explains in his 1942 restoration account: “...scalloped shelves as mentioned in the cost sheet were omitted, and while it seems likely that the closet with scrolled shelves had a wooden back constructed of wide beaded boards...it was decided to plaster the entire side walls and ceilings of both closets”. The cost sheet Lindsey refers to is the 1774 Bill of Robert May and Company.

Therefore, in the eighteenth century, the chamber was used not only for sleeping but was considered a multi-purpose, private room primarily occupied by the mistress. According to the connotation of the term ‘chamber’:

“Although sleeping arrangements varied greatly, the mistress often occupied the chamber while her husband slept in the hall. As a result, the chamber acquired a feminine association that informed its use by women and children throughout the eighteenth century, even though husbands often cohabitated there.”¹⁰⁵

Architectural historian Willie Graham proposes a theory about the use of verdigris-based paints and glazes in the eighteenth century. At mid-century, verdigris was an extremely popular color of finishes applied in public, entertaining spaces in houses of the extremely wealthy. By the third quarter of the eighteenth century, the color is still extremely fashionable and used in houses of the gentry, but by then it is used in secondary spaces as well as prominent locations. For the first-floor northwest chamber of the Corbit House, the choice has been made to apply a relatively expensive and flashy finish to what is architecturally perhaps a secondary space. Despite the chamber’s plain woodwork, it likely served a semi-public role and was a room used as part of the entertainment circuit. The room may also have been considered a public space for socializing on a small scale, such as for teas and meals with close friends and relatives. Most importantly, the chamber is dramatically differentiated from the other rooms of the house (or rather, from the other three rooms analyzed for this study) with the application of a green, copper resinate glaze. Such a treatment may be considered a form of distinction from the use of other rooms in the house and may also be a way to compensate for the lack of other room treatments.¹⁰⁶

¹⁰⁵ *An Illustrated Glossary of Early Southern Architecture and Landscape*, s.v. “chamber.”

¹⁰⁶ Willie Graham. Personal communication, June 2003.

5.3 Drawing room

As with the parlor, the architecture of the drawing room reflects room hierarchy and the original function as a formal entertaining space.¹⁰⁷ The drawing room is by far the most elaborate room in the house; its woodwork is similar to the great drawing room of the Powel House in Philadelphia (1765). The paint analysis has revealed original paint colors that are very different from those matched in the 1978 analysis. The two previous paint analyses identified the greenish-blue paint of the second generation as the original finish coat, as they must have thought the underlying paint was simply a primer. Instead, this paint layer, which is a stone color, is the original finish of the woodwork (with the exception of the brown baseboards) and is similar in color to that of the first-floor parlor.

The first-generation paint above the plaster is a tannish-pink color; there is no evidence of wallpaper fibers above the plaster sealant to indicate the existence of wallpaper in the first generation, nor is wallpaper evident in later generations. It is not surprising that the plaster fields of the drawing room were painted as opposed to papered. Wallpaper used as a statement to indicate fashion consciousness would not be necessary in a room with such refined architectural detail and high style. Perhaps for the same reason, the doors of the drawing room are painted the same stone color as the woodwork; the doors are not painted with a graining imitation.

5.4 Second-floor, southeast chamber

In this room, the two previous paint analyses also mistook the second-generation green paint as the original finish coat. The first-generation finish of the woodwork is a stone color, very similar to that of the parlor and drawing room. Unfortunately, the original

¹⁰⁷ At the time of William Corbit's death in 1818, however, the room was used as a bedchamber. John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware* (London: Associated University Press, 1989), 43.

wall plaster finish was not found in the sampling and analysis conducted for this study. The original treatment of the plaster would undoubtedly have a great impact on the chambers appearance and interpretation. It is possible the walls were originally hung with paper in combination with the stone color woodwork. With such a treatment, the room would emphasize Corbit's affluence and was perhaps considered the best chamber.

The room has a special relationship with direct access to the drawing room. One possibility is that the original plaster finish of the walls was painted the same tannish-pink color as the drawing room plaster fields. If this were the case, it would imply the drawing room and adjacent chamber were used as a suite of rooms. The hierarchy of the southeast chamber is slightly higher than of the other two chambers on the second floor. All three second-floor chambers are finished with fielded paneling on the fireplace wall yet only the southeast chamber has a mantel; the northwest and southwest chambers have plain ovolo moldings around the fireplace openings.¹⁰⁸ In comparison to the first-floor, northwest chamber, the architectural hierarchy of the second-floor, southeast chamber is more pronounced; the latter is appointed with a fireplace mantel and original cornice, two elements absent in the first-floor, northwest chamber.¹⁰⁹ These features distinguish the southeast room as a comparatively more impressive space such that this chamber was possibly intended for guests when necessary. Eighteenth-century sleeping arrangements were always in fluctuation since visitors, including friends and extended family members, constantly changed the mix of household occupants. In addition, with the exception of the mistress of the house and the elderly, individual family members, especially children,

¹⁰⁸ The second-floor, southwest chamber, with access to the attic, would have been the least important of the chambers as this space would have had the least amount of privacy.

¹⁰⁹ H.L. Lindsey writes in the 1942 restoration account of the first-floor, northwest chamber: "Originally the cornice extended only across the paneled end. It was decided, however, to extend it around the entire room. Old cornice was salvaged from an old house being razed in Philadelphia, and after cleaning off the paint and repairing the fret, was erected."

did not have their own rooms.¹¹⁰ It is possible that the second-floor, southeast chamber was typically used by William Corbit's as his bed chamber and that his wife slept in the first-floor northwest chamber. In general, however, family members would have moved their sleeping quarters to suit the visitors and the household arrangements of the moment.¹¹¹

¹¹⁰ *Gunston Hall Room Use Study*, <http://www.gunstonhall.org/architecture/roomuse/domesticspaces.html> (April 26, 2003).

¹¹¹ *Ibid.*

CONCLUSIONS

The results of this study provide new information regarding the original finishes of four interior rooms of the Corbit-Sharp House. The original decorative schema is ascribed to the deliberate choices made by William Corbit concerning the sophistication of his mansion and contributed one aspect with respect to the hierarchies of interior space. The well-carved woodwork was pretreated with a shellac and oil sealant in preparation for the finishes; the finishes themselves were of the highest quality and applied by a trained craftsperson.

The original finish of the first-floor, northwest chamber – a copper resinate glaze with verdigris – is markedly different from the other three spaces analyzed. The unique treatment of the first-floor chamber is a profound selection that discretely distinguishes the space from its architecture and from the finishes of the other three rooms. The woodwork of the parlor, drawing room and second-floor, southeast chamber was originally painted a stone color. The stone color represent a relatively muted color palette that perhaps served as a backdrop for more elaborate furnishings, textiles or even possibly wallpaper. Unfortunately, the original finishes of the plaster walls of the parlor and second-floor, southeast chamber were not found for this investigation. The original treatment of the plaster would have tremendous influence on the appearance and interpretation of these two rooms. It must be strongly stressed that the choices of finishes are only one facet of the rooms' decor. The finishes treatments would have been considered in conjunction with the room furnishings and level of architecture. Thus, this research provides key information for interpreting the original appearances of these rooms and painting them with the appropriate first-period finishes. But the physical record is incomplete and will have to be filled out by further research into the surviving

finishes and decoration of comparable houses, as well as further investigation of written documents such as invoices, wills, diaries and correspondence related to the Corbit-Sharp House and other residences of the same quality and time period.

APPENDICES

Figure A-1

Corbit-Sharp House, Odessa Delaware

Front, east elevation

Photograph by author, August 2002



APPENDIX A

Figure A-2

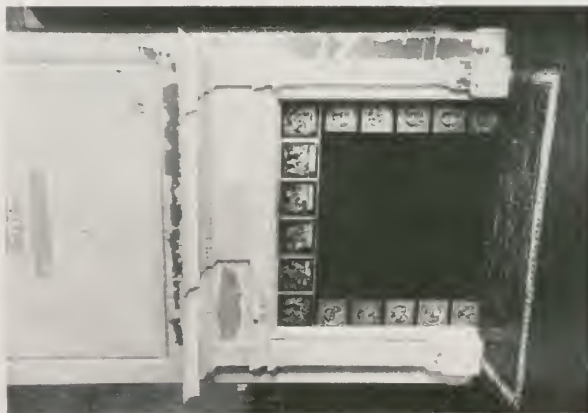
Fireplace mantel and overmantel; first-floor, northwest chamber (below)

From George Fletcher Bennett, *Early Architecture of Delaware*. New York: Historical Press, Inc., 1932. Page 187.

EARLY ARCHITECTURE OF DELAWARE



WILSON HOUSE, ODESSA



CORBIT HOUSE, ODESSA

Figure B-1

Corbit-Sharp House; first-floor plan

From John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware*. Second Edition. London: Associated University Press, 1989. Page 41.

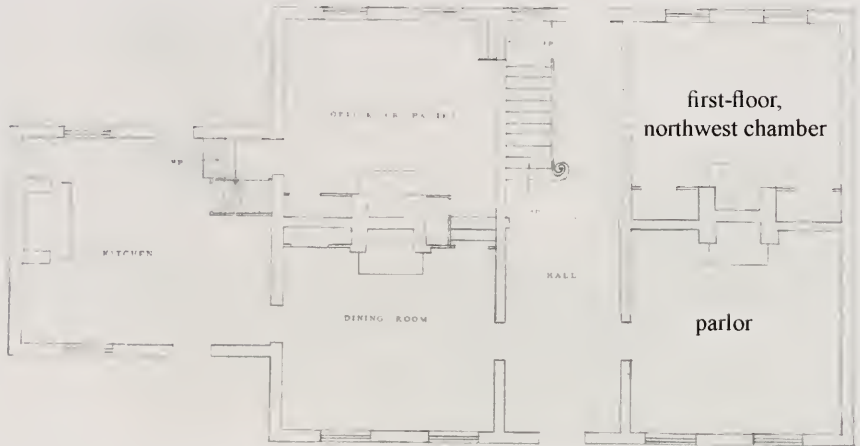
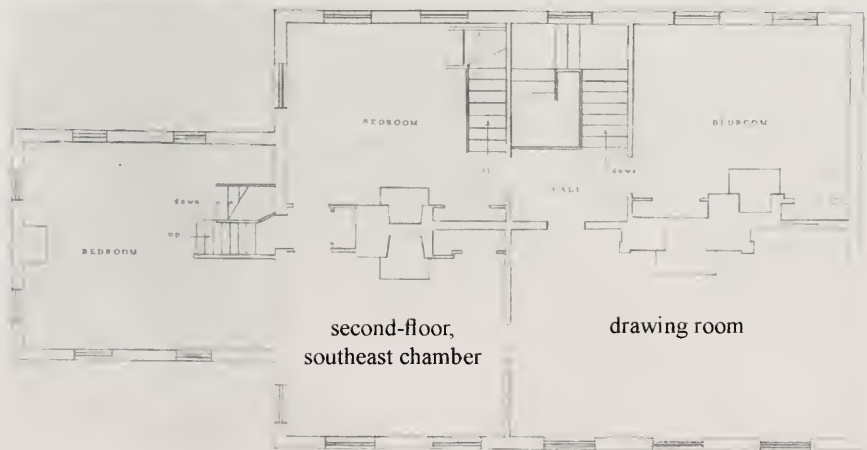


Figure B-2

Corbit-Sharp House; second-floor plan

From John A.H. Sweeney, *Grandeur on the Appoquinimink: The House of William Corbit at Odessa, Delaware*. Second Edition. London: Associated University Press, 1989. Page 41.



APPENDIX C

Figure C-1 Winterthur Memorandum May 31, 1978; page 1 of 4
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

MEMORANDUM

May 31, 1978

TO: Horace Hutchkiss
FROM: Anou Clapp and Michael Rault
SUBJECT: Original paint layers in the Parlor and Master Bedroom of the first floor of the Garbit-Sharp House.

Three methods were used to determine the original surface coatings:

- a) Tooling with scalpels in situ on as many surfaces as was thought necessary to establish that the original layers were present. Then, upon finding that, determining if there was any variation in paint colors from one surface to another.
- b) Tooling continued in the laboratory at Winterthur on chosen sections of the doors and moldings. Clearing large enough areas for color matching. Layer-by-layer was removed to reveal the ones which must be the original surface coatings. Notes were made on all the paint layers found on each section beginning with the present surface coating (see the enclosed charts.)
- c) Making cross-sections of paint strips so that they could be examined by reflected light under the chemists' microscope, to make certain that the bottom layers are actually those uncovered for color matching.

An additional trip was made to Odessa with Kinky McCann to determine if our conclusions about paint colors agreed with his decisions. The adjustment of colors by physical means to compensate for the yellowing of linseed oil (the painting medium) did not seem necessary. In the case of the light greys of the woodwork in both rooms however, it was decided to select paints slightly less yellow than those uncovered.

Our conclusions are:

PARLOR

1. The baseboard and the chair-rail were originally a rich red-brown. See the cleared area on the baseboard to the left of the fireplace.
2. The door to the hall was grained inside and out with a lightish, variegated graining, probably meant to be mahogany. See the area uncovered on the inside of the door.
3. The rest of the woodwork was painted a light, warm grey. See the area uncovered on the lower part of the left doorjamb and on the splinter taken from the molding below the chair-rail to the right of the right window.

APPENDIX C

Figure C-1 Winterthur Memorandum May 31, 1978; page 2 of 4 Historic Houses of Odessa Archives, Winterthur Museum curatorial files

MASTER BEDROOM

The originality to the room of much of the window's in respect, and in many areas it has been stripped of the original paint. Therefore, our conclusions were based on the layering found on the door into the hall and its jambs, which are confidently believed to have been part of the room originally. The door of the closet to the right of the fireplace had layering similar to that of the hall door, whereas the one to the left does not. Records of changes in the room indicate that the right closet door was once removed to the second floor and then returned to the master bedroom in the restoration of the 1930's.

1. The door to the hall was grained inside and out in a similar fashion to the parlor door.
NOTE: This door is unique because original layering survives on each of its sides, whereas the hall-sides of the other doors have been stripped of paint. There are simply traces left to show that they too were grained.
2. The rest of the woodwork was painted a light grey, cooler than the paint in the parlor.

AFC & MH

APPENDIX C

Figure C-1 Winterthur Memorandum May 31, 1978; page 4 of 4
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

[illegible]

APPENDIX C

Figure C-2 Winterthur Memorandum September 11, 1978; page 1 of 4
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

MEMORANDUM

September 11, 1978

TO: Marjorie Patchkian
FROM: Anne Clapp and Michael Heslip
SUBJECT: Conclusions Concerning the Colors of the Original Display Layers
on a Number of the Rooms in The Garfield-Simpson House

I. First Floor Front Hall

A. Panelling

All the tested spots in the hall indicated that the panelling below the chair-rail has been stripped, so that no original paint was found on the first floor. (Admittedly the search was not very thorough because we had undertaken that the hall would not be repainted at this time since it had been redecorated recently.) However, on the vertical member against the left wall at the head of the stairs, original paint was found and an area cleared. If the likely assumption is made that the panelling was painted the same on both floors, this coating, very different from the present one, may be seriously considered. It is a yellow-brown glaze over a light tan paint. *(Some in London on Silver Bedroom?)*

B. Baseboard and Chair-rail

Both the list of the baseboard and the top of the chair-rail were painted a dark brown, probably a little more red than the present paint. This color was found on all the baseboards and chair-rails in all of the rooms examined. On both the first and second floors, it was found to encircle the door jambs. It did not span the doors of the first floor, nor the vertical members of the staircase.

An area cleared for matching can be found on the baseboard to the "left" of the fireplace in the front parlor.

C. Doors

Main door. The back of the front door has an original display paint very like the present outside layer; that is, a light warm tan.

An area cleared for matching can be found in the lower center of the door.

Room Doors. All the room doors on the first floor are believed to have been grained inside and out with a red graining like mahogany except the inside of the hall door of the Master Bedroom. Evidence for this conclusion was found on the hall-side of the Master Bedroom, the inside of the Parlor door and the inside of the Dining Room door. The hall-sides of the doors of the Dining Room and the Bedroom have been stripped.

An area cleared for matching can be found on the inside of the Parlor door on the middle left panel.

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Figure C-2 Winterthur Memorandum September 11, 1978; page 2 of 4
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

Horace Boudinles

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Sept. 11, 1978

D. Plaster

There is evidence in the rooms that the plaster surfaces of the walls were painted with a calcimine-type paint of soft shades. It is difficult to say whether the bottom layers are contemporary to the paint on the wood because this water-based paint could have been easily removed. However, in most instances, there are many layers below the present outside paint, first of calcimine and later of oil.

An attempt was made to clear an area to the right of the left pilaster. Some confusion exists in the lower layers, so that a further search should be made. The bottom layer seems to be a light rosy tan.

II First Floor Parlor

- A. All woodwork except door, baseboard and chair-rail, was painted a warm gray. Evidence was found on a great many test spots throughout the room.

Two areas cleared for matching can be found on the lower left door jamb and on the quarter round on the left upright above the fireplace. When the latter area is lightly scraped to remove the outermost skin, a good idea of the color is obtained. The color is a medium warm gray.

- B. Baseboard and top of the chair rail, see description in I-B. A: In all rooms, the moldings above the baseboard and below the chair-rail, are painted the same color as the panelling of the room.

- C. Plaster. Not tested, because it was very recently painted.

III. Master Bedroom, First Floor

Much of the woodwork in this room is suspected of not being original to the room. Sampling, therefore, was confined to the hall door, the door frame and the right closet door.

A. Panelling

If the surfaces tested are indicative of the whole, all the woodwork except the baseboard and top of the chair-rail, had an original display coating formed by a glazing technique: on the wood lies a thin tan colored paint; over it, is a thin rather strong green which, in turn, is covered with a dark red-brown resinous coating.

Areas cleared for matching can be found on the right jamb of the hall door and on the inside of the hall door. Interestingly enough, the green underprint can be seen on the inside of the right closet door. The presumption can be that the painters did not cover the inside of the door, a subordinate area, with the modifying resinous coating.

B. Baseboard and Chair-Rail

See I-B.

C. Plaster

Not tested because it probably is not original.

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Historic Houses of Odessa Archives, Winterthur Museum curatorial files

Bowser Kotschickas

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Sept. 11, 1978

IV. Dining Room

- A. All woodwork exhibits an original display paint formed by the kind of glazing technique found in the Master Bedroom. Here, a warm taupe-grey paint lies against the wood and over it is a thin reddish slumped glazing. The resulting color of the glazed paint can be seen in two cleared areas:

on the right jamb of the left window, and on the ceiling cornice to the right of the fireplace. Both places are the same color in spite of the fact that one is in the strong light of the window and the other in the dark and dusty area of the fireplace cornice.

- B. Baseboard and Top of Chair-Rail

See I-B.

- C. Plaster

Not tested because of the presence of the wallpaper. However, a corner of the paper was lifted high enough to see that plaster had originally been painted, not papered.

V. Long Room (Blue Parlor) on the Second Floor

- A. Panelling

A small piece of the firework below the ceiling cornice was removed and brought to Winterthur, where it was exposed to ultraviolet radiation for 30 hours. This was done after the bottom display paint had been exposed by tooling. The effect of the exposure was dramatic: a light, dull green color was changed by the bleaching of the yellowed linseed oil medium of the paint to a light grey-blue. The Munsell Color Book was used for matching. The color of the panelling seems to lie between chips 5B 3/1 and 5A 8/2.

- B. Baseboard and Top of Chair-Rail

See I-B. Again the baseboard going encircled the door jambs. But the ungrained, painted doors of the second floor were spared at the bottom by a continuation of the dark red-brown baseboard stripe.

- C. Plaster

The alligatoring of the paint on the plaster was not explained. It may have been deliberately done by later painters, because it is not apparent in the lowest layers. The color of the lowest calcimine paint that is present is a light rosy grey, close to Munsell Color Chip 7.5 YR 8 1/2.

VI. Southeast Bedroom, Second Floor

- A. Panelling

A large piece of the molding was removed from the left side of the fireplace mantle and brought to Winterthur, and, with the piece of firework from the Long Room, exposed to 30 hours of ultraviolet radiation. The exposure had little effect on the color, leading us to believe that the original display layer is unmodified by time. It is a strong grey-green which is very close to the Munsell Color Chip 5B 3 1/1.

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Norace Horchikis

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F. Baseboard and Top of Chair-Rail

See I-B.

C. Plaster

Here the bottom layer is a fairly strong yellow ochre, which lies between Marshall Color Chips 10 YR 8/4 and 8/4.

VII Northwest Bedroom, Second Floor

A. Panelling

By good luck, a large section of the original display paint is readily seen. It is on the inside of the last closed door, where it is recently dented. It is a deep rosy tan. It was found by test in many other places of the woodwork; see, for example, the cornice to the right of the fireplace. There is no evidence of glazing in this room.

B. Baseboard and Top of Chair-Rail

This is like that in all the other rooms examined. Here it certainly spanned the entire fireplace wall.

C. Plaster

The plaster was not tested because it probably is not original.

NOTE: The Northwest Bedroom was not examined because it has been recently redecorated. However, it is suggested that the baseboard and the top of the chair-rail be checked. Their present color makes this room seem different in character from the other rooms.

It has been planned, that, should repainting be authorized, Michael Healy will accompany Ernie McCann to help determine the interpretation of the various paint colors in the making of color swatches.

AEC:mac

CC: Ch. Glen Romm-1
George Kefilly

APPENDIX C

Figure C-3 Winterthur Memorandum December 5, 1978; page 1 of 3
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

COBBLE-SHARP HOUSE

(Restoring four rooms to original color)

First Floor Parlor

Ceiling matched to an off white. Plaster in this room is not original.

Side Walls

Tinted off white. Ten shades darker than ceiling.

Panels and Trim

Matched to original color. This color can be found on lower right side of panel facing south side of trim. I call this a light putty color. To reproduce this color I used an oil base woodwork material with touch of enamel for a hard finish. This material was tinted with raw sienna, raw umber and burnt umber -- two coats. This material was put on all trim and panels as a finish.

Baseboard and Chair Rail

Original color was found next to fireplace, left side, on baseboard. The new finish was made out of a dark oil base undercoat material, tinted with red vermilion, burnt sienna, burnt umber and a touch of raw umber. Finished off with a satin varnish.

Door Entering Parlor

This door was found to be grained originally. Graining can be found on inside of door, left panel, top center. The overall color has a maple appearance with a red mahogany grain. To reproduce this grained door I used a four-step procedure:

1. Oil base undercoat was used as a ground coat. This material was tinted to a yellow buff color. Two coats of this material was put on.
2. One coat of flat dark maple stain was put on.
3. For graining I made a red mahogany oil stain. A small bristle brush was cut down to use as a graining tool.
4. Finish coat is flat varnish tinted with burnt umber and raw sienna.

First Floor Master Bedroom

Ceiling

Off white. Tinted with raw umber and raw sienna.

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Side Wall

Off white. Ten shades darker than ceiling. Plaster in this room is not too old.

Panels and Trim - two steps

1. Two coats oil base undercoat. (I call this a ground coat.) This material was tinted with lamp black, turn sienna and carous yellow.
2. Flat varnish glaze brushed on lightly. This material was tinted with burnt umber. The original color can be found on main interior door trim and also on interior right closer door. Interior closer door was ground out, but no glaze was put on so procedure could be checked.

Banchoard and Chair Rail

Same color as Parlor.

Door Entering Room

Grained same as Parlor.

Second Floor North West Bedroom

Ceiling

Off white.

Side Walls

Off White. Tinted with raw sienna and raw umber.

Woodwork

Original color can be found inside closet doors. Material used for this finish was oil base undercoat, tinted with burnt umber, raw sienna and chrome yellow (m). In a few years this color will tone down closer to the original.

Banchoard and Chair Rail

Same color as Parlor and Master Bedroom.

Long Room Second Floor

Ceiling

Off white. Oil base under was put on first because of a water base paint was used before. Finished off with two coats. Off white ceiling paint.

APPENDIX C

Figure C-3 Winterthur Memorandum December 5, 1978; page 3 of 3
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

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Plastered Panels

The original plaster panel can be found right side of fireplace. Color was matched to Anna Clapp's specifications. I call this finish color gray/pink. Base material is a latex satin enamel tinted with yellow ochre, red vermilion and raw umber.

Wood Trim

Gray/blue oil based satin sheen finish tinted with Prussian Blue and touch of red vermilion. This color also was tinted to Miss Clapp's specifications. The original color was analyzed in Miss Clapp's laboratory.

Chair Rail and Baseboard

Same color as in Parlor.

First Floor Dining Room

Door entering room off of hall was grained same as Parlor and Master Bedroom doors. No painting was done in this area in 1978. The original color can be found on left window, right side of frame. Color looks like a yellow ochre with a touch of vandyke brown. Baseboard color same as Parlor.

- NOTE: 1) All ceilings and side wall paint (new material) is a vinyl latex material. Trim finish is made from an oil-base material.
- NOTE: 2) Master Bedroom (door entering room) paint was removed from interior side of door. Old layers of paint had deteriorated down to wood surface. By not removing, new finish would be impossible to keep on door.

Submitted by:

Ernest T. McGinn
Ernest T. McGinn, Supervisor
Winterthur Paint Shop

12/5/78

APPENDIX C

Figure C-4 Winterthur Memorandum January 15, 1979; page 1 of 2
Historic Houses of Odessa Archives, Winterthur Museum curatorial files

MEMORANDUM

January 15, 1979

TO: Horace Notchkiss
FROM: Michael Heslop *MH*
SUBJECT: Paint Layer Rectangles, The Corbit-Sharp House

In most cases when the "windows" through the various lower paint levels had been prepared in about 1939, several layers had not been distinguished, so that the actual number of layers cannot be counted in these rectangles. Most important to note was that the paint color applied in 1939 had also been daubed into the area representing the earliest level, thereby falsifying the documentary value of these rectangles.

On January 11, 1979, I made these adjustments in the rectangles of exposed lower paint layers in the rooms of The Corbit-Sharp House:

First Floor Parlor

"1939 Green" covers the smallest rectangle. This was partially scraped to reveal, at the bottom edge, a tan that is darker than the tan chosen as original, due to the darkening of linseed oil after being covered by later paint.

First Floor Bedroom

The rectangle inside the right closet door had shown an intense blue--now removed--as original, but this had been applied during the last repainting and was not accurate. A small area below this was uncovered to show the original dark green that was followed by a brown glaze on the rest of the woodwork in the room. (The inside of the closet had not been glazed originally.) The exposed brown-over-green original areas have been repainted, since they were located in prominent areas on the door jamb.



Dining Room

Strips through the paint layers were uncovered on the inside right vertical frame of left windows. This location had to be chosen since it is one of the few accessible areas where all of the old paint layers remain. Most of the room has been scraped down in the past.

Second Floor Large Bedroom

The existing rectangle on the right side of the fireplace had the 1939 blue-green color in the "original" rectangle. An area below this was uncovered and now has a similar blue-green appearance that is not accurate until it has been bleached by exposure to a traviolet light. This process was especially important in this room since the darkening and yellowing of linseed oil changed the pale blue so significantly. A piece of the cornice was uncovered and bleached in this way and the room has been repainted to match that blue. A cream colored paint is also visible in the smallest rectangle and represents the priming layer before the blue was applied.

APPENDIX C

Figure C-4 Winterthur Memorandum January 15, 1979; page 2 of 2
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Memo
Horace Aultsaking
Page 2
January 15, 1979

Second Floor Southwest Bedroom

Stripes through the paint layers have been exposed to the left of the fireplace. In a corner next to the ultraviolet bleaching done to reveal the blue in the large bedroom, the green of this room did not show a noticeable difference after exposure to ultraviolet, since the subtraction of some yellow from green does not affect its color.

Second Floor Northwest Bedroom

The existing rectangle had as the "original" color a pale green that was in fact the second paint applied in the room. Part of the small rectangle was removed to reveal the deep tan that is original, the same tan that can be seen on the inside of the left closet door.

MH:mc

CC: Anne Clapp
Charles Hummel
Eddie McCann
George Kelly

Table D-1 Parlor Sample Locations

Sample Number	Wall Elevation	PARLOR SAMPLE LOCATIONS			Horizontal Measurement
		Element	Description	Vertical Measurement	
1	west	panel	chimney breast, proper left side, raised panel within bottom layer of scrape test	60 7/8" above floor	7 1/2" from west wall
2	west	panel	chimney breast, proper left side, raised panel below scrape test	59 1/4" above floor	6 1/2" from west wall
3	west	overmold	lower crosshead molding	58 1/2" above floor	7 3/4" from chimney breast corner
4	west	overmold	upper crosshead molding	58 1/2" above floor	7 3/4" from west wall
5	west	overmold	right side pulvinated molding	58 1/2" above floor	
6		chimney breast baseboard	right side, rounded edge, area of damage	1 1/2" above baseboard molding	
7		chimney breast baseboard	chimney breast, right side of chimney breast	5" above floor	
8	west	chimney breast panel	chimney breast, right side where mantel meets panel	52 1/2" above floor	
9	west	surbase	chimney breast, right side, surbase molding	31 1/2" above floor	3 1/2" to left of west wall
10	west	panel	right side of fireplace, center stile at nail hole for picture	84 1/2" above floor	31 1/2" from north wall
11	west	surbase	picture, to right of fireplace, edge closest to fireplace	32 1/4" above floor	61" to left of north wall
12	east	wainscot	raised panel below north window in area of picture	21 1/4" above floor	50 1/2" to right of north wall
13	east	baseboard	precut panel base	20 1/4" above floor	68 1/2" to right of north wall
14	east	baseboard window sill	baseboard below north window	31 1/4" above floor	38 1/4" to right of north wall
15	east	window architrave	north window architrave, left vertical side	71" above floor at area of previous loss	
16	east	plaster	north window, plaster, left vertical edge where it meets window architrave		
17	south	door pediment	door to hall, pediment, proper right side, edge of molding	76 1/2" above floor	65" to right of east wall
18	south	door pediment	door to hall, pediment, pulvinated frieze, proper right side	92 1/4" above floor	65" to right of east wall
19	south	door architrave	door to hall, architrave, upper left side near L hinge	72 7/8" above floor	1 1/4" to left of hinge
20	south	door	door to hall, parlor side, stile above upper L hinge	81 1/4" above floor	1" to right of left edge
21	south	door	door to hall, parlor side, stile below upper L hinge	81 1/4" above floor	1" to right of left edge
22	south	door	door to hall, parlor side, stile below upper L hinge	61 1/2" above floor	1 1/2" to right of left edge
23	south	door	door to hall, parlor side, left stile	61 1/2" above floor	1" to right of left edge
24	south	door architrave	architrave, inner to north side	66 1/2" above floor	1" from chimney breast corner
25	south	door architrave	architrave, inner to right side	66 1/2" above floor	1" from chimney breast corner
61	east	wainscot	wainscot to right of south window	10" above floor	13 1/4" to left of south wall
62	east	surbase	surbase to right of south wall	40 1/2" above floor	1 1/4" to left of south wall
63	east	surbase	base, to right of south wall	38 1/2" above floor	4 3/4" to right of east wall
81	south	door	door to hall, parlor side, stile below upper L hinge	54" above floor	13 1/4" to left of south wall
82	south	door	door to hall, parlor side, stile below upper L hinge	54" above floor	13 1/4" to left of south wall
83	south	door	door to hall, parlor side, stile below upper L hinge	54" above floor	13 1/4" to left of south wall
84	south	door	door to hall, parlor side, stile below upper L hinge	54" above floor	13 1/4" to left of south wall
85	south	door	door to hall, parlor side, stile below upper L hinge	54" above floor	13 1/4" to left of south wall
86	south	baseboard	between lower left raised panel and center stile	53 3/4" above floor	63" to right of east wall
98	east	plaster	pieces of curbed plaster at intersection of wall and crown molding/window architrave		
99	east	crown molding	crown molding/window architrave		
100	east	plaster	plaster directly above right (south) window architrave		
101	east	window architrave	top, flat horizontal of window architrave		
102	south	door	raised panel molding	70 1/4" above floor	5 1/2" to right of huge side

Table D-2 First-floor, northwest chamber Sample Locations

Sample Number	Wall Elevation	FIRST-FLOOR, NORTHWEST CHAMBER SAMPLE LOCATIONS			
		Element	Description	Vertical Measurement	Horizontal Measurement
24	east	closet door	right side of fireplace, closet side, right edge of left stile	44 1/2" above floor	
25	south	door architrave	architrave, top horizontal	85" above floor	10" to right of left edge
26	south	door architrave	door to hall, architrave, right vertical (hinge side)	48" above floor	53 3/4" to left of west wall
27	south	baseboard	top edge, to left of door architrave	5 1/2" above floor	53 3/4" to right of fireplace (east) wall
28	south	door	door to hall, room side, center rail, side near right stile	33 1/2" above floor	70 1/2" to left of west wall
29	south	door	fireplace surround, bottom HT hinge	8 1/2" above floor	65 7/8" to left of west wall
30	east	panel	fireplace surround, left side molding edge, area of damage	37" above floor	68 1/2" to right of north wall
31	east	closet door	right side of fireplace, closet side, left stile	18" above floor	41 7/8" to right of left edge
66	east	closet door	right side of fireplace, closet side	16" above floor	15 1/2" to right of door edge, hinge side
67	east	closet door	right side of fireplace, closet side	23 1/2" above floor	1 1/2" from door edge, hinge side
68	west	surbase	surbase	32" above floor	32" to right of south wall (southwest corner)
69	west	window-surbase	right (north) window, panel return to window sash	58 1/2" above floor	1 1/2" to right of edge
70	north	surbase	surbase	29 1/4" above floor	41 1/2" to left of east wall (northeast corner)
71	north	baseboard	baseboard	4 1/4" above floor	50" to left of east wall (northeast corner)
72	south	surbase	surbase	29 1/2" above floor	52 1/2" to left of west wall (southwest corner)
87	south	door	raised panel molding	27 1/2" above floor	70" to left of west wall
88	south	door architrave	flat side of architrave, perpendicular to wall surface	59 1/4" above floor	59 1/4" to left of west wall
103	south	door	door edge, non-hinge side	29 1/2" above floor	

Table D-3 Drawing room Sample Locations

[illegible]

Table D-4 Second-floor, southeast chamber Sample Locations

Sample Number	Wall Elevation	SECOND-FLOOR, SOUTHEAST CHAMBER SAMPLE LOCATIONS			
		Element	Description	Vertical Measurement	Horizontal Measurement
55	north, east	door, baseboard	door to drawing room, right stile, bottom right rounded baseboard molding	2 7/8" above floor 3 3/4" above floor	11 5/8" to left of hinge side 8 7/8" to left of southeast corner
56	east	surbase	just below left side of south window	30" above floor	(south wall) 85 1/2" to left of southeast corner
57	east	window architrave	south window, window architrave, left side molding	36 1/2" above floor	(south wall) 55 1/4" to right of southwest corner
58	west	closet door	closet doors to left of fireplace, right door of pair, right side stile, just above lower right J. hinge	6" above floor	(south wall) 56" to right of southwest corner
59	west	closet door	closet doors to left of fireplace, right door of pair, lower right J. hinge	5 1/2" above floor	(south wall)
60	west	panel	to left of fireplace, panel return between closet doors and fireplace	26 1/2" above floor	3 7/8" to right of west wall panel
79	north	surbase	baseboard	29 1/2" above floor	10 5/8" to left of east wall
80	north	baseboard	baseboard	4" above floor	18 1/2" to left of east wall (northeast corner)
81	west	panel	panel return of chimney breast, left side, scrape	57" above floor	2 1/4" from west wall
82	south	baseboard	baseboard	4" above floor	18 7/8" to left of west wall
83	south	surbase	surbase, rounded edge	34 1/4" above floor	87 3/8" to left of south wall
90	north	door	door to drawing room	21 1/4" above floor	(southeast corner)
96	north	door architrave	door architrave, door to drawing room	88 1/2" above floor	5 1/4" to left of hinge side
103	north	crown molding	crown molding	128" above floor	
104	east	plaster	plaster above southern (right) window architrave	106 1/2" above floor	37" / 43" to left of south wall

Table E-1

Stratigraphy: parlor, woodwork
Photomicrograph Figures F-2, F-5, and F-6

APPROXIMATE TIME PERIOD applied circa 1978 to present	GENERATION	PARLOR WOODWORK (Samples 2, 18, 21)			LAYER FUNCTION	COMMENTS
		APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT		
Winterthur ownership present by 1954 to 1978 Sharp / Winterthur ownership	11	dull, cream-color	no autofluorescence, black		top coat	modern paint
	10	pale green	slight autofluorescence		top coat	John A. H. Sweeney describes the parlor walls as a "moss green" color in the 1954 <i>The Magazine Antiques</i> article "The Corbit house in Odessa, Delaware"
probably applied circa 1938–1942 to circa 1954. Sharp ownership	9	light tan	slight autofluorescence		base coat	color shown in photo of 1939 <i>Ladies' Home Journal</i> article, must be an old photograph
		dark tannish-yellow, layer applied in select layers	slight autofluorescence		top coat	layer applied in select areas
	8	darker yellow	slight autofluorescence		top coat	possibly chrome yellow
		bright yellow (two applications)	whitish autofluorescence		base coat	same paint layers are seen on door architrave of adjacent first floor, NW chamber (Sample 25); obvious abrasion of surface in some areas, likely treatment for restoration-era preparation
		off-white	light blue autofluorescence		top coat	
1922–1938 rental property ~~~~~ 1877–1922 occupancy of Daniel Wheeler Corbit (parlor connected to adjacent NW chamber)	7	white	grayish-blue autofluorescence		base coat	
		off-white	tannish-gray, autofluorescence		top coat	
	6	white	gray autofluorescence		base coat	
		off-white	light blue autofluorescence, sparkly		top coat	
unknown, post 1834 unknown, post 1834 unknown applied circa 1774	5	white (two applications)	blue-gray autofluorescence, sparkly		base coat	same paint layers are seen on door architrave of adjacent first floor, NW chamber (Sample 25)
	4	pale pink (Sample 4)	whitish autofluorescence		top coat	
		cream-color	whitish autofluorescence		base coat	
	3	pale grayish brownish-white (two applications in areas)	whitish autofluorescence		top coat	
	2	pale greenish	slight grayish-brown autofluorescence		top coat	possible oil varnish
	1	thin brownish layer (two applications in areas)	thin brownish layer, no autofluorescence		top coat	
		off-white	whitish autofluorescence		primer	
	wood substrate		orangeish autofluorescence within fibers		sealant	evidence of shellac sealant

Table E-2

Stratigraphy: parlor, baseboard
Photomicrograph Figures F-7, F-8, and F-9

APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN PARLOR baseboards (sample 13)		LAYER FUNCTION	COMMENTS
		REFLECTED VISIBLE LIGHT	ULTRAVIOLET LIGHT		
applied circa 1978 to present Winterthur ownership present by 1954 to 1978 Sharp / Winterthur ownership	13	dark brown	no autofluorescence, black	top coat	
		dark brown	no autofluorescence, black	base coat	
		pale green	slight whitish autofluorescence	top coat	
circa 1938 to 1954 Sharp ownership	11	yellow, semi-translucent	slight whitish autofluorescence	top coat	
		yellow (two applications)	slight autofluorescence	base coat	
probably applied circa 1938 – 1942 Sharp ownership	10	dark yellow (two applications)	tan	top coat	
Sharp ownership rental property 1877 – 1922 occupancy of Daniel Wheeler Corbit (plot connected to adjacent NW room)	9	opaque white	white autofluorescence	top coat	disrupted layer, scraped
	8	semi-translucent white	bluish-white autofluorescence	base coat	
		white	bluish autofluorescence	top coat	
		semi-translucent white	pale blue autofluorescence	finish coat	
unknown, post 1834 unknown unknown unknown applied circa 1774	7	off-white	tan, slight autofluorescence	top coat	
			bright white autofluorescence	base coat	
	6	light brown	grayish, no autofluorescence	finish coat	
	5	brown	no autofluorescence	varnish	
		opaque white (from applications)	bluish-gray, sparsely autofluorescence	base coat	
	4	tanish	autofluorescence	base coat	
	3	dark red-brown	tanish, slight autofluorescence	top coat	
	2		bluish-white autofluorescence	top coat	possible plant resin varnish
			virtually no autofluorescence	base coat	
applied circa 1774	1	dark red-brown	no autofluorescence	finish coat	possible plant resin varnish
		white	no autofluorescence, black	top coat	
			orangeish autofluorescence within fibers	primer	
	wood substrate			sealant	evidence of shellac sealant

Table E-3

Stratigraphy: parlor, plaster wall
Photomicrograph Figures F-10 and F-11

PARLOR plaster walls (Sample 100)				
APPROXIMATE TIME PERIOD applied circa 1978 to present	GENERATION	APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	LAYER FUNCTION
Winterthur ownership	6	white	no autofluorescence; black	top coat
present by 1954 to 1978 Sharp / Winterthur ownership	5	pale green (two applications)	slight autofluorescence	top coat
probably applied circa 1938 - 1942 to circa 1954	4	dark tanish yellow	slight autofluorescence	top coat
Sharp ownership	3	yellow (two applications)	slight autofluorescence	top coat
unknown, used 1834	2	off-white colorless	gray, slight autofluorescence grayish, slight autofluorescence	top coat
	1	semi-translucent, cream-color	bright white autofluorescence	plaster finish
applied circa 1774	white plaster substrate brown / black / white, coarse, granular plaster			plaster finish brown coat plaster

John A. H. Sweeney describes
the parlor walls as a "moss
green" color in the 1954 *The
Magazine Antiques* article
"The Corbit house in Odessa,
Delaware."

Table E-4

Stratigraphy: parlor, door to hall
Photomicrograph Figures F-12, F-13 and F-14

APPROXIMATE TIME PERIOD	GENERATION	PARLOR door to hall (Samples 20, 24, 102)		LAYER FUNCTION	COMMENTS
		REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT		
applied circa 1978 to present Winterthur ownership present by 1954 to 1978 Sharp / Winterthur ownership	12	brown translucent	grayish autofluorescence	varnish	graining sequence
		thin red layer	thin black layer	glaze coat	
		cream color (two applications)	no autofluorescence, black	base coat	
probably applied circa 1938 - 1942 to circa 1954 Sharp ownership	11	pale green	slight whitish autofluorescence	top coat	possible plant resin varnish
		semi-translucent yellow	whitish autofluorescence	finish coat	
		cream color	bluish autofluorescence, sparkly	top coat	
1922 - 1938 renal property ~~~~~ 1877 - 1922 occupancy of Daniel Wheeler Corbit (parlor converted to adjacent NW chamber)	9	yellow	autofluorescence	base coat	same paint layers are seen on door architrave of adjacent first floor, NW chamber (Sample 25), obvious abrasion of surface in some areas, likely treatment for restoration-era preparation
		white			
		off-white	light blue autofluorescence	top coat	
	8	white	grayish-blue autofluorescence, sparkly	base coat	same paint layers are seen on door architrave of adjacent first floor, NW chamber (Sample 25)
		off-white	tannish-gray, autofluorescence	top coat	
		white	gray autofluorescence	base coat	
unknown	7	off-white	light blue autofluorescence, sparkly	top coat	same paint layers are seen on door architrave of adjacent first floor, NW chamber (Sample 25)
unknown	6	white (two applications)	blue-gray autofluorescence, sparkly	base coat	graining sequence evidence of shellac sealant
		off-white	autofluorescence	top coat	
		off-white	autofluorescence	base coat	
unknown	5	light brown	light brown	top coat	graining sequence
		light brown		top coat	
		dark brown	dark brown, no autofluorescence	top coat	
unknown	4	translucent	gray, slight autofluorescence	varnish	graining sequence
				imitation	
				primer	
applied circa 1774	3	reddish brown	reddish brown	graining	evidence of shellac sealant
		yellow	yellow	autofluorescence	
		white	orange autofluorescence within fibers	sealant	
	2				
	1				
	wood substrate				

APPENDIX E

Table E-5

Stratigraphy: first-floor northwest chamber, closet door
Photomicrograph Figures F-15, F-16 and F-17

FIRST FLOOR, NORTHWEST CHAMBER					
APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN		LAYER FUNCTION	COMMENTS
		REFLECTED VISIBLE LIGHT	LUMINOUS VIOLET LIGHT		
applied circa 1978 to present	9	dark green	no autofluorescence	top coat	modern paint
Winterthur ownership present by 1959 to 1978	8	blue-green	virtually no autofluorescence	top coat	
Sharp / Winterthur ownership applied circa 1938 to circa 1954	7	semi-translucent white	no autofluorescence, black white autofluorescence	top coat	
to circa 1934		opaque white	white autofluorescence	base coat	
Sharp ownership	6	dark brown, semi-translucent translucent white	no autofluorescence, black white autofluorescence	base coat	graining, disrupted surface
unknown, post 1834	5	translucent white	no autofluorescence, black white autofluorescence	base coat	graining sequence
unknown, post 1834	4	translucent white	no autofluorescence, black white autofluorescence	base coat	graining sequence
unknown, post 1834	3	white	blue-gray autofluorescence, sparkly	base coat	thick layer
unknown	2	cream-solar	whitish autofluorescence	base coat	multiple applications
unknown	1	pale grayish/brownish-white	slight grayish autofluorescence	finish coat	possible plant resin varnish
applied circa 1774		green	no autofluorescence, black white autofluorescence	base coat	uncertain whether original
		thin white	orangeish autofluorescence within fibers	base coat	evidence of shellac sealant
		wood substrate		sealant	

Table E-6

Stratigraphy: first-floor northwest chamber, door architrave
 Photomicrograph Figures F-18, F-19 and F-20

FIRST FLOOR, NORTHWEST CHAMBER door architrave, door to hall (Sample 25, 83)					
APPROXIMATE TIME PERIOD applied circa 1978 to present	APPEARANCE IN REFLECTED VISIBLE LIGHT		APPEARANCE IN ULTRAVIOLET LIGHT		COMMENTS
	GENERATION			LAYER FUNCTION	
Wimberthur ownership present by 1959 to 1978 Sharp / Wimberthur ownership probably applied circa 1938 - 1942	10	dark green	no autofluorescence	top coat	modern paint
	9	translucent layer	whitish-blue autofluorescence		disrupted layer
probably applied circa 1938 - 1942 to circa 1954 Sharp ownership unknown		blue-green	virtually no autofluorescence	top coat	color shown in photo of 1959 <i>Ladies Home Journal</i> article
	8	red	no autofluorescence, black	top coat	
Sharp ownership unknown		white	bright white autofluorescence	base coat	
	7	semi-translucent white	white autofluorescence	top coat	thick base coat layer
unknown 1922 - 1938 rental property ~~~~~	6	opaque white	white autofluorescence	base coat	
	5	cream-color	tanish with autofluorescence	top coat	same paint layers are seen on woodwork of adjacent first floor, parlor (Sample 2, 18)
1877 - 1922 occupancy of Daniel Wheeler Corby (parlor connected to adjacent NW room)		off-white	grayish-blue autofluorescence	base coat	
	4	white (two applications)	light blue autofluorescence, sparsely	top coat	
post 1834			blue-gray autofluorescence, sparsely	base coat	same paint layers are seen on woodwork of adjacent first floor, parlor (Sample 2, 18)
unknown	3	thin translucent off-white	bright white autofluorescence	finish coat	possibly paint resin varnish
unknown		cream-color	autofluorescence	top coat	
	2	off-white	autofluorescence	finish coat	
		coarse, light brown	tanish autofluorescence	base coat	

Table E-7

Stratigraphy: first-floor northwest chamber, door to hall
Photomicrograph Figures F-21 and F-22

FIRST FLOOR, NORTHWEST CHAMBER DOOR TO HALL (Sample 5/7)						
APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN REFLECTED VISIBLE LIGHT		APPEARANCE IN ULTRAVIOLET LIGHT		LAYER FUNCTION
applied circa 1978 to present Winterthur ownership	unknown	laminar	reddish brown	whitish-blue autofluorescence	synthetic varnish imitation	graining sequence base coat
			reddish brown	no autofluorescence	graining	
			cream color	no autofluorescence	base coat	
unknown	multiple generations	INCOMPLETE PIN STRATIGRAPHY		no autofluorescence	finish coat	disrupted layers most likely due to heat-applied method used to aid in mechanical stripping of paint
				no autofluorescence	primer	
				autofluorescence	finish coat	
				no autofluorescence	primer	
				autofluorescence	finish coat	
applied circa 1774	1 wood substrate			orange autofluorescence within fibers	primer	evidence of shellac sealant
					sealant	

Table E-8

Stratigraphy: first-floor northwest chamber, restoration woodwork
Photomicrograph Figures F-23, F-25 and F-26

FIRST FLOOR, NORTHWEST CHAMBER Restoration Woodwork (Samples 30, 38, 70)					
APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN REFLECTED-VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	LAYER FUNCTION	COMMENTS
applied circa 1978 to present	4	dark-green	no autofluorescence	top coat	
MS-4000 paint applied circa 1978 to present by 1995 to 1978 Sharp / Winterthur	3	blue-green red	virtually no autofluorescence whitish autofluorescence	top coat top coat	color shown in photo of 1959 <i>Ladies' Home Journal</i> article
probably applied circa 1938 - 1942 to circa 1954	2	white	slight grayish-brown autofluorescence	base coat	
Sharp ownership unknown	1	greenish-gray	slight autofluorescence	top coat	first generation at previous location
unknown origin	wood substrate				wood salvaged from old material according to restoration account

Table E-9

Stratigraphy: drawing room, woodwork
Photomicrograph Figures F-28 and F-29

DRAWING ROOM WOODWORK, SAMPLE 10-11				
APPROXIMATE TIME PERIOD applied circa 1978 to present	GENERATION	APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	LAYER FUNCTION
Wimertur ownership	11	light blue	no autofluorescence, black	top coat
present by 1954 to 1978 Sharp / Wimertur ownership	10	green	top autofluorescence, black	blush top paint
		green	slight autofluorescence	top coat
	9	pale yellow	tannish, slight autofluorescence	base coat
unknown, post 1834		translucent	white autofluorescence	finish coat
	8	white, coarse particles, semi-translucent	bluish auto-fluorescence, sparkly	top coat
		white, opaque	bluish autofluorescence	base coat
unknown, post 1834	7	translucent	white autofluorescence	finish top
unknown, post 1834	6	pale pink	brownish	blush and top coats
unknown, post 1834	5	cream-color	brownish	top coat
unknown	4	pale pink	whitish autofluorescence	base coat
unknown	3	cream-color	autofluorescence	top coat
unknown	2	translucent	slight autofluorescence	top coat
unknown	1	green	slight autofluorescence, tannish color	top coat
applied circa 1774		stone color	autofluorescence	top coat
		stone color	autofluorescence	top coat
	wood substrate		orangeish autofluorescence within fibers	sealant
				evidence of shellac sealant

incident paint (sample 40)
color described in the 1954
The Magazine Antiques article
"The Corbitt house in Odessa,
Delaware,"
possible plant resin varnish

possible plant resin varnish
three applications

possible plant resin varnish
has been applied (sample 41)
Prussian blue pigment* with
large, coarse white particles

Table E-10

Stratigraphy: drawing room, wainscot
 Photomicrograph Figures F-30, F-31, F-32, F-33 and F-34

APPROXIMATE DATE OF APPLICATION	GENERATION	DRAWING ROOM WAINSCOT SAMPLE 32-17-78			LAYER FUNCTION	COMMENTS
		APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT		
applied circa 1978 to Wimberly ownership present by 1954 to 1978 Sharp / Wimberly ownership	11	light blue	no autofluorescence, black	no autofluorescence, black	top coat	modern paint
	10	green pale yellow	slight autofluorescence autofluorescent	slight autofluorescence autofluorescent	top coat base coat	color in the 1954 <i>The Magazine</i> <i>Antiques</i> article "The Corbit house in Odessa, Delaware" possible plant resin varnish
unknown, present in 1932	9	translucent white, coarse particles, opaque	laminar, slight autofluorescence	laminar, slight autofluorescence	base coat finish coat	white paint present in 1932 book <i>Early Provenance of Delaware</i> possible plant resin varnish
	8	translucent white, coarse particles, opaque	white autofluorescence, sparkly	white autofluorescence, sparkly	top coat	possible plant resin varnish
unknown unknown	7	translucent cream-color	white autofluorescence	white autofluorescence	finish coat top coat	possible plant resin varnish
	6	translucent white, opaque	bluish autofluorescence	bluish autofluorescence	base coat	(layer present in sample 32)
unknown	5	translucent semi-translucent	grayish-blue autofluorescence	grayish-blue autofluorescence	top coat finish coat	possible plant resin varnish
	4	translucent, tan color	grayish autofluorescence	grayish autofluorescence	top coat finish coat	possible plant resin varnish
unknown, post 1834 unknown	3	cream-color	yellowish autofluorescence	yellowish autofluorescence	base and top coat	two applications
	2	white, semi-translucent	bluish autofluorescence	bluish autofluorescence	top coat	
applied circa 1774	1	stone color	slight autofluorescence	slight autofluorescence	top coat	
	word substrate	stone color	slight autofluorescence	slight autofluorescence	primer	evidence of shellac sealant
			orange autofluorescence within fibers	orange autofluorescence within fibers	sealant	

Table E-11

Stratigraphy: drawing room, baseboard
Photomicrograph Figures F-35 and F-36

APPROXIMATE TIME PERIOD to which present Wintierthurs present by 1984 to 1978	GENERATION	DRAWING BODY baseboard (Sample 10)			COMMENTS
		APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	LAYER FUNCTION	
applied present	unknown	dark brown	no autofluorescence	top coat	
		white	bluish autofluorescence	base coat	
Wintierthurs present by 1984 to 1978	unknown	dark brown	no autofluorescence, black	top coat	
		white	white autofluorescence, sparsely	base coat	
Sharp / Wintierthurs ownership	unknown	translucent	white autofluorescence, sparsely	finish coat	possible plant resin varnish
		white (two applications)	white autofluorescence, sparsely	base coat	
unknown	unknown	pinkish	bluish autofluorescence, sparsely	top coat	
		<i>possible generations that have been assigned</i>			
unknown	4	off-white	autofluorescence, bluish	top coat	
		cream-color	autofluorescence	top coat	
unknown	2	dark brown	slight autofluorescence	top coat	possible plant resin varnish
		translucent	whitish autofluorescence	finish coat	possible plant resin varnish
applied circa 1774	1	dark brown	slight autofluorescence	top coat	
		white	orange autofluorescence within fibers	sealant	evidence of shellac sealant

Table E-12

Stratigraphy: drawing room, plaster fields
 Photomicrograph Figures F-37, F-38, F-39, F-40 and F-41

APPROXIMATE DATE OF APPLICATION	GENERATION	DRAWING ROOM Plaster Fields (Photomicrographs F-37, F-38, F-39, F-40, F-41)			LAYER FUNCTION	COMMENTS
		APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT		
probably 1954 to 1978 Sharp / Winterthur ownership	12	dull pink	no autofluorescence, black	no autofluorescence, black	top coat	modern paint
		translucent	white autofluorescence	white autofluorescence	finish coat	
	11	pink	tarnish, no autofluorescence	tarnish, no autofluorescence	top coat	The plaster fields are described as a beige color in 1954 <i>The Magazine Antiques</i> article "The Corbin house in Odessa, Delaware" by John A.H. Sweeney, Jr.
	10	white	whitish, slight autofluorescence	whitish, slight autofluorescence	base coat	
	9	pink	pinkish, slight autofluorescence	pinkish, slight autofluorescence	top coat	
	8	pink	pinkish, slight autofluorescence	pinkish, slight autofluorescence	base coat	
	7	pink	pinkish, no autofluorescence	pinkish, no autofluorescence	top coat	
	6	white	white, no autofluorescence	white, no autofluorescence	top coat	
	5	pink	tarnish, slight autofluorescence	tarnish, slight autofluorescence	base coat	
	4	translucent	white, slight autofluorescence	white, slight autofluorescence	top coat	
applied circa 1774:	plaster substrate	light orange	light orange, no autofluorescence	light orange, no autofluorescence	plaster substrate	replastered
	3	white			top coat	
	2	pink			top coat	
	1	rose pink			top coat	
		rose pinkish tan			plaster finish	
		semi-translucent			plaster finish	
	white plaster substrate				plaster finish	
	brown/black white,				plaster finish	
	coarse, granular plaster				plaster	
					plaster	

* The pink color described from observation of the photomicrographs likely appears as a beige color as applied to the walls

Table E-13

Stratigraphy: second-floor southeast chamber, woodwork
Photomicrograph Figures F-44 and F-46

SECOND-FLOOR SOUTHEAST CHAMBER				
APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT (Sample 50.60)	LAYER FUNCTION
applied circa 1978 to present	7	light green	no autofluorescence; black	top coat
Winterthur ownership unknown, probably applied during Sharp ownership	6	light green white (no applications)	gray	base coat
unknown	5	translucent	autofluorescence	finish coat
unknown	4	cream color	bluish-white autofluorescence	finish coat
unknown	3	translucent	dark gray	top coat
unknown	2	translucent	bluish-white autofluorescence	finish coat
unknown	1	green color	autofluorescence	top coat
applied circa 1774	wood substrate	stone color	autofluorescence within fibers	primer
			orange autofluorescence within fibers	sealant
				evidence of shellac sealant

Table E-14

Stratigraphy: second-floor southeast chamber, baseboard
Photomicrograph Figures F-48, F-49, F-50, F-51 and F-52

SECOND FLOOR, SOUTHEAST CHAMBER baseboard (Sample 55, 80, 174)					
APPROXIMATE TIME PERIOD	GENERATION	APPEARANCE IN REFLECTED VISIBLE LIGHT	APPEARANCE IN ULTRAVIOLET LIGHT	LAYER FUNCTION	COMMENTS
applied circa 1978 to present Winterthur axeship applied 1978 unknown, possibly applied circa 1938 to 1942	10	brown	reddish, no autofluorescence	base coat	
	9	grayish-brown	no autofluorescence, black	top coat	
	8	brown	no autofluorescence, brown	base coat	
	8	gray	no autofluorescence, dark gray	top coat	
unknown	7	translucent red-brown	no autofluorescence, black	top coat	possibly floor wax
	7	white	no autofluorescence, black	primer	
	6	cream-color	tannish autofluorescence	top coat	
	5	white	autofluorescence	top coat	
	5	light blue	no autofluorescence, orange	top coat	
	4	cream-color	whitish autofluorescence	top coat	possible plant resin varnish
	4	cream-color	tannish autofluorescence	top coat	
	3	off-white	autofluorescence	base coat	multiple layers
	3	cream-color	very bluish autofluorescence	bluish coat	possible plant resin varnish
	2	red-brown	virtually no autofluorescence	top coat	
unknown	2	translucent	slight bluish autofluorescence	top coat	
	2	red-brown	no autofluorescence	top coat	possible plant resin varnish
	1	white	autofluorescence	primer	
applied circa 1774	wood substrate		orangeish autofluorescence within fibers	sealant	evidence of shellac sealant

Table E-15

Stratigraphy: second-floor southeast chamber, plaster wall
 Photomicrograph Figures F-53 and F-54

SECOND-FLOOR, SOUTHEAST CHAMBER <small>plaster wall (Sample 104)</small>					
APPROXIMATE TIME PERIOD	GENERATION	REFLECTED VISIBLE LIGHT	ULTRAVIOLET LIGHT	LAYER FUNCTION	COMMENTS
circa 1978 to present	7	white	no autofluorescence	finish coat	
unknown	6	white	no autofluorescence	base coat	
unknown	5	pale blue	no autofluorescence	finish coat	
unknown	4	pale blue off-white	bright autofluorescence	base coat	
unknown	3	pink off-white	bright autofluorescence	finish coat	
unknown, post 1834	2	white	bright autofluorescence	base coat	
	1	semi-translucent, cream-color	grayish-blue, slight autofluorescence	top coat	probably limewash
applied circa 1774		white plaster substrate brown / black / white, coarse, granular plaster	bright white autofluorescence	plaster finish sealant	
				plaster coat	
				plaster	

Figure F-1a. Sample 64 parlor, surbase
reflected visible light 125X magnification

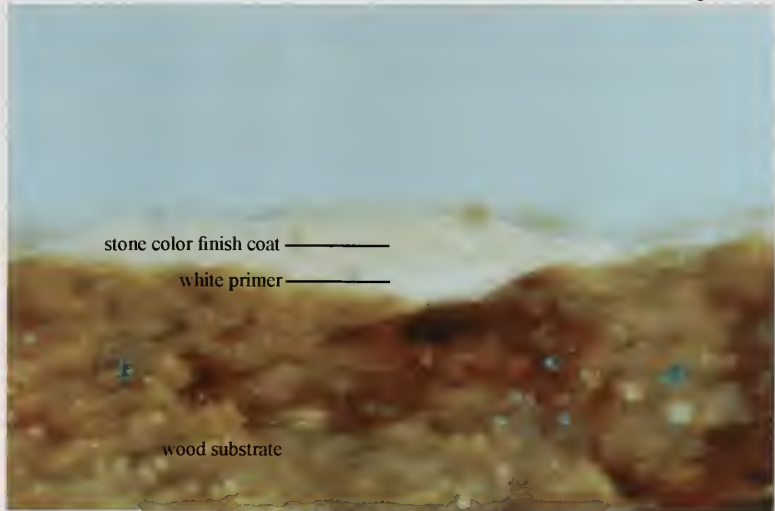


Figure F-1b. Sample 64 parlor, surbase
ultraviolet light 125X magnification



Figure F-2a.

Sample 2

parlor, panel
reflected visible light

125X magnification



Figure F-2b.

Sample 2

parlor, panel
ultraviolet light

125X magnification



Figure F-2c.

Sample 2
DCF

parlor, panel
ultraviolet light

125X magnification



Figure F-2d.

Sample 2

parlor, panel
reflected visible light

250X magnification



Figure F-2e.

Sample 2

parlor, panel
ultraviolet light

250X magnification



Figure F-3a. Sample 4 parlor, mantel
reflected visible light 125X magnification



Figure F-3b. Sample 4 parlor, mantel
ultraviolet light 125X magnification



Figure F-3c.

Sample 4
FITC

parlor, mantel
ultraviolet light

125X magnification



Figure F-4a.

Sample 4

parlor, mantel
reflected visible light

125X magnification



Figure F-4b.

Sample 4

parlor, mantel
ultraviolet light

125X magnification



Figure F-4c.

Sample 4
TTC

parlor, mantel
ultraviolet light

125X magnification



Figure F-5a. Sample 18 parlor, door pediment
reflected visible light 50X magnification



Figure F-5b. Sample 18 parlor, door pediment
ultraviolet light 50X magnification

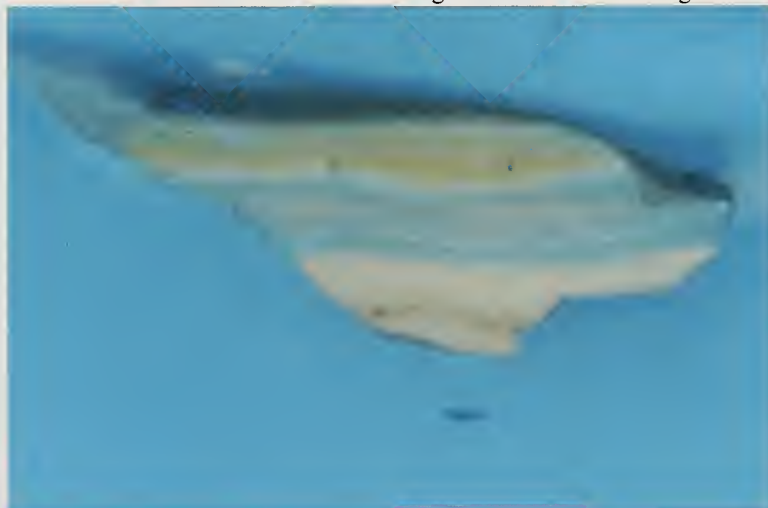


Figure F-6a. Sample 61 parlor, overmantel
reflected visible light 125X magnification



Figure F-6b. Sample 61 parlor, overmantel
ultraviolet light 125X magnification



Figure F-7a. Sample 13 parlor, baseboard
reflected visible light 125X magnification



Figure F-7b. Sample 13 parlor, baseboard
ultraviolet light 125X magnification



Figure F-7c.

Sample 13
DCF

parlor, baseboard
ultraviolet light

125X magnification



Figure F-8a. Sample 13 parlor, baseboard
reflected visible light 125X magnification



Figure F-8b. Sample 13 parlor, baseboard
ultraviolet light 125X magnification



Figure F-9a. Sample 13 parlor, baseboard
reflected visible light 125X magnification

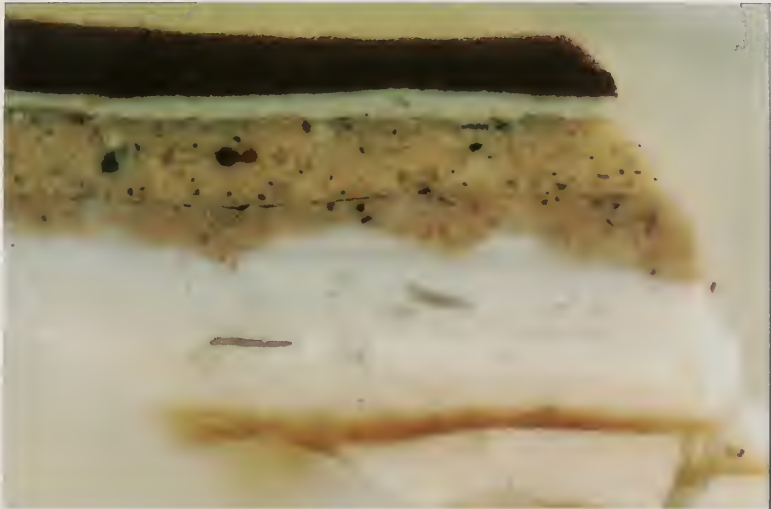


Figure F-9b. Sample 13 parlor, baseboard
ultraviolet light 125X magnification

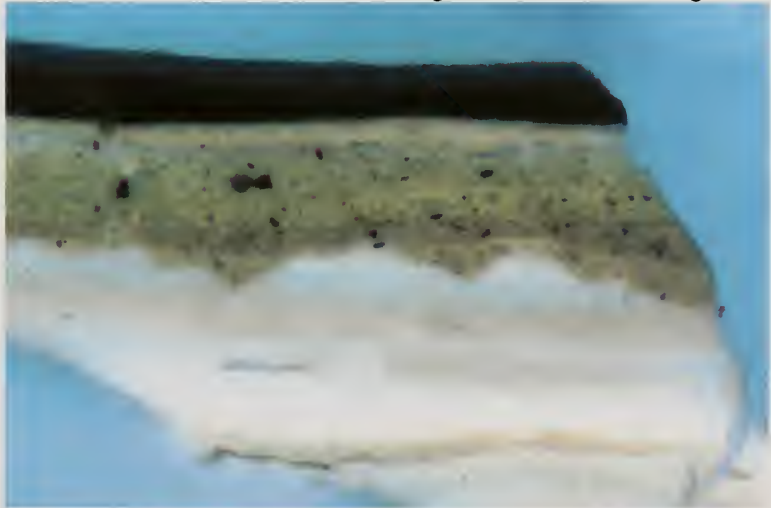


Figure F-10a. Sample 100 parlor, plaster wall
reflected visible light 50X magnification

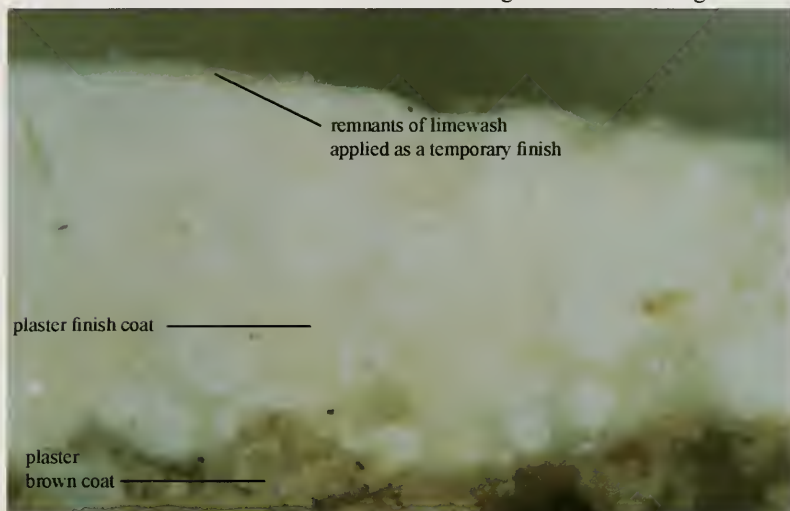


Figure F-10b. Sample 100 parlor, plaster wall
ultraviolet light 50X magnification

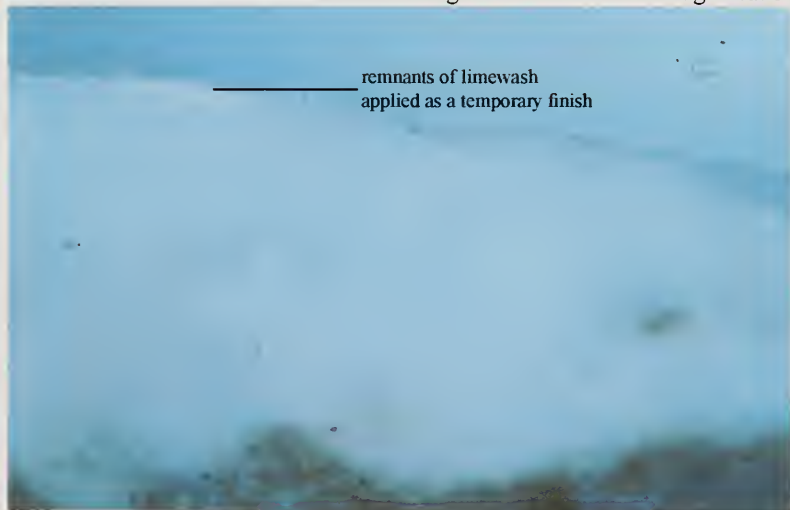


Figure F-10c.

Sample 100
TTC

parlor, plaster wall
ultraviolet light

50X magnification



Figure F-10d.

Sample 100

parlor, plaster wall
ultraviolet light

125X magnification



Figure F-11a. Sample 100 parlor, plaster wall
reflected visible light 125X magnification

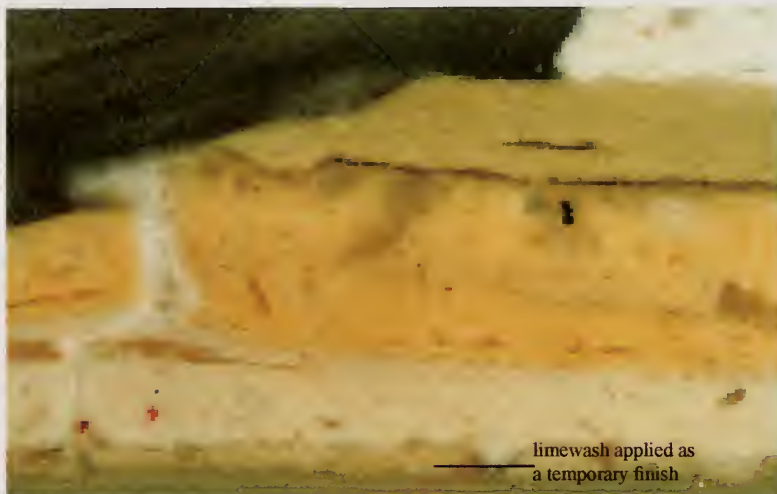


Figure F-11b. Sample 100 parlor, plaster wall
ultraviolet light 125X magnification

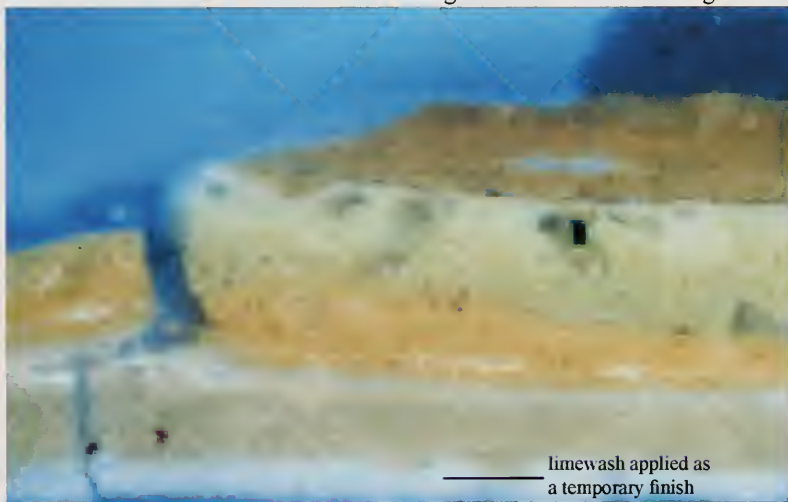


Figure F-11c. Sample 100 parlor, plaster wall
TTC ultraviolet light 125X magnification



Figure F-11d. Sample 100 parlor, plaster wall
TSQ ultraviolet light 125X magnification



Figure F-12a. Sample 102 parlor, door
reflected visible light 125X magnification



Figure F-12b. Sample 102 parlor, door
ultraviolet light 125X magnification

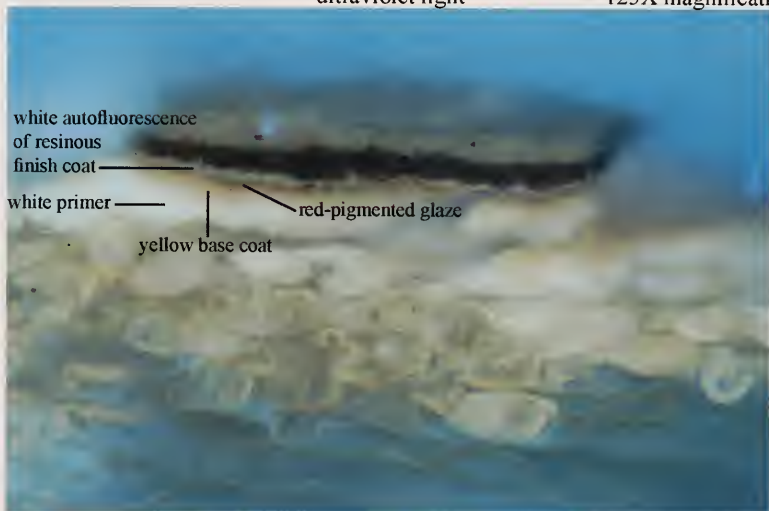


Figure F-12c.

Sample 102
DCF

parlor, door
ultraviolet light

125X magnification

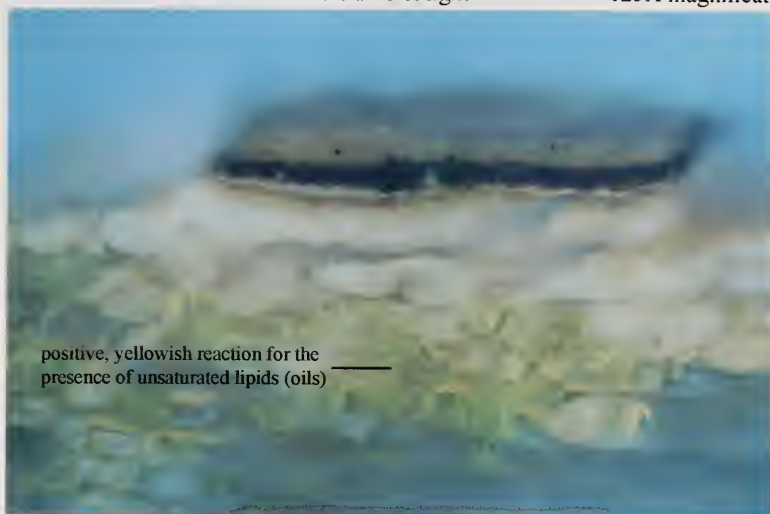


Figure F-13a. Sample 84 parlor, door
reflected visible light 125X magnification



Figure F-13b. Sample 84 parlor, door
ultraviolet light 125X magnification



Figure F-14a.

Sample 20

parlor, door
ultraviolet light

125X magnification

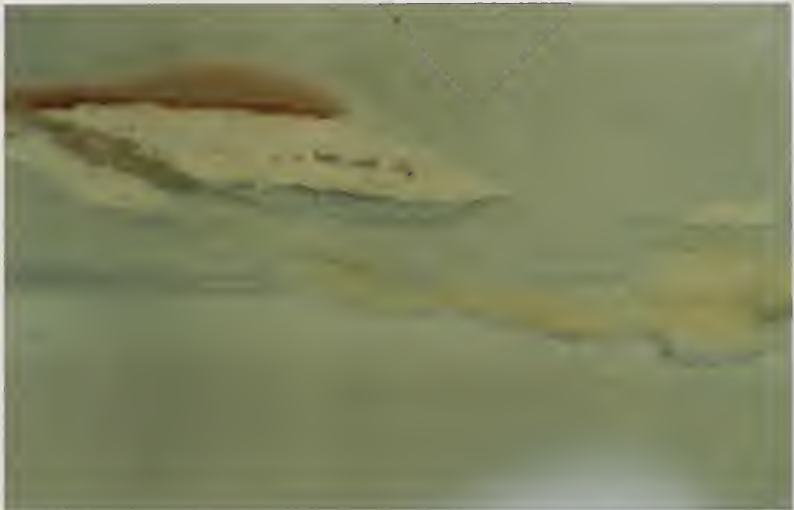


Figure F-14b.

Sample 20

parlor, door
ultraviolet light

125X magnification



Figure F-15a. Sample 66 first-floor northwest chamber, closet door
reflected visible light 125X magnification



Figure F-15b. Sample 66 first-floor northwest chamber, closet door
raking visible light 125X magnification

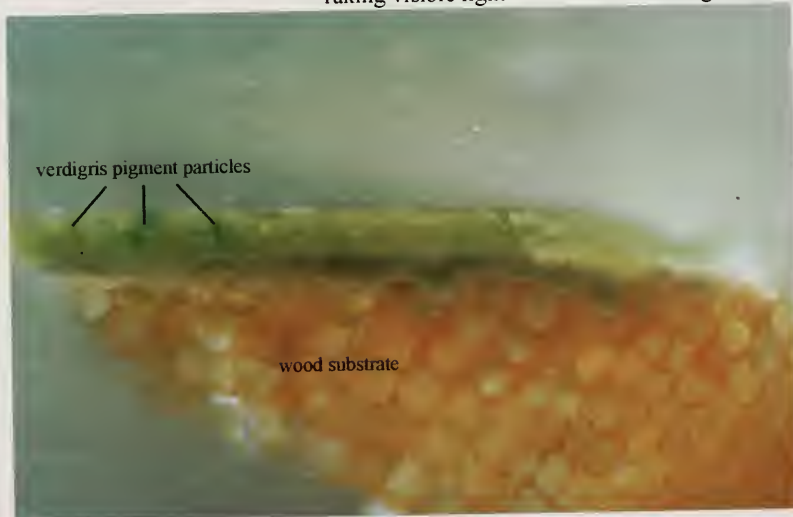


Figure F-15c. Sample 66 first-floor northwest chamber, closet door
reflected visible light 250X magnification

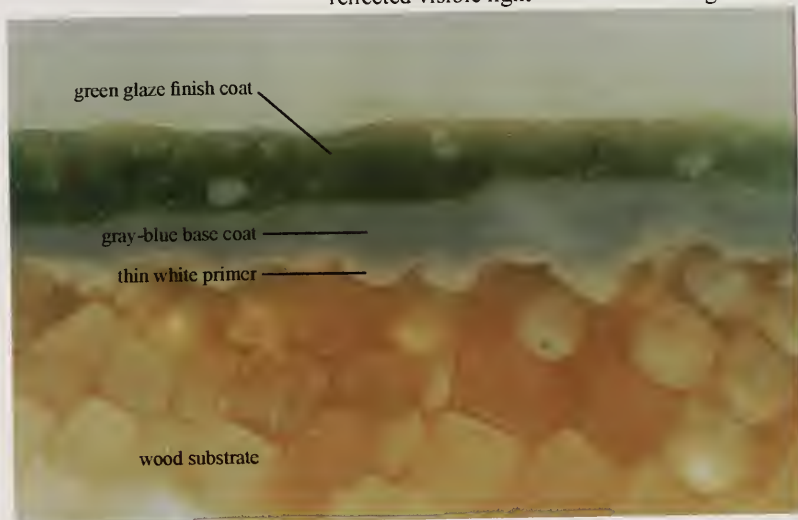


Figure F-15d. Sample 66 first-floor northwest chamber, closet door
ultraviolet light 250X magnification

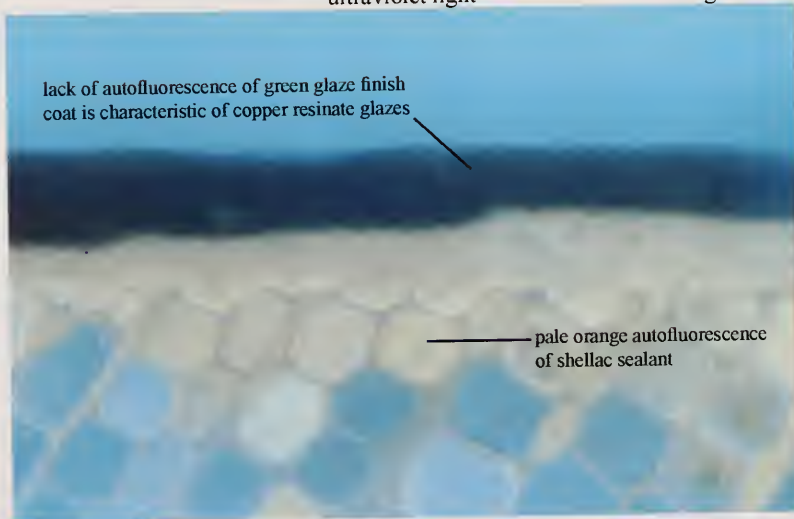


Figure F-15e. Sample 66 first-floor northwest chamber, closet door
DCF ultraviolet light 250X magnification

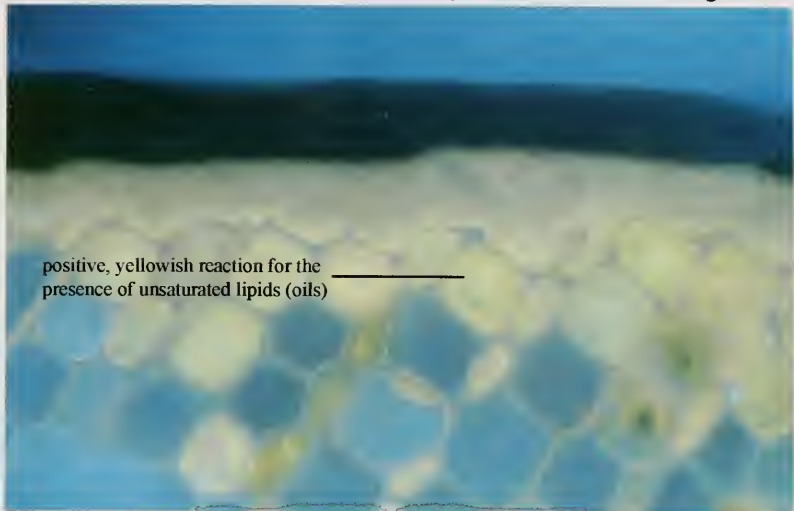


Figure F-16a. Sample 67 first-floor northwest chamber, closet door
reflected visible light 125X magnification



Figure F-16b. Sample 67 first-floor northwest chamber, closet door
ultraviolet light 125X magnification

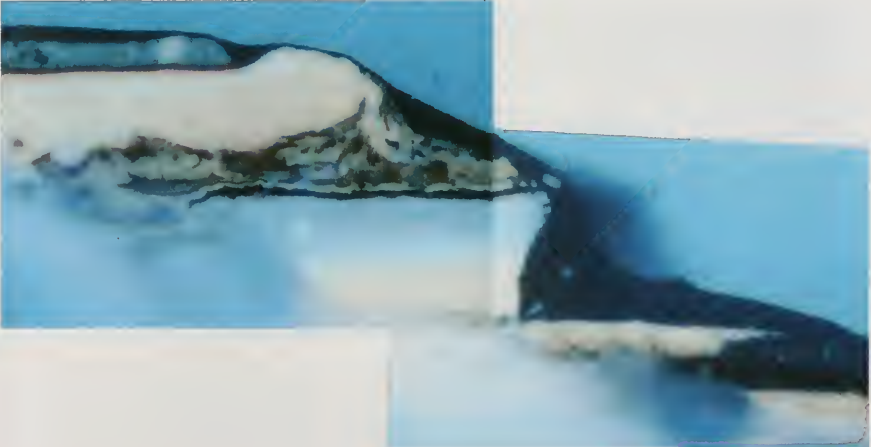


Figure F-17a. Sample 24 first-floor northwest chamber, closet door
reflected visible light 125X magnification

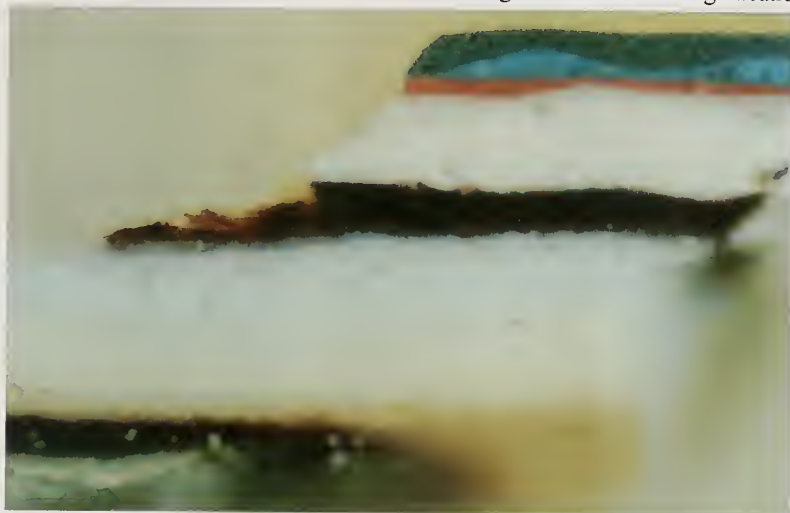


Figure F-17b. Sample 24 first-floor northwest chamber, closet door
ultraviolet light 125X magnification

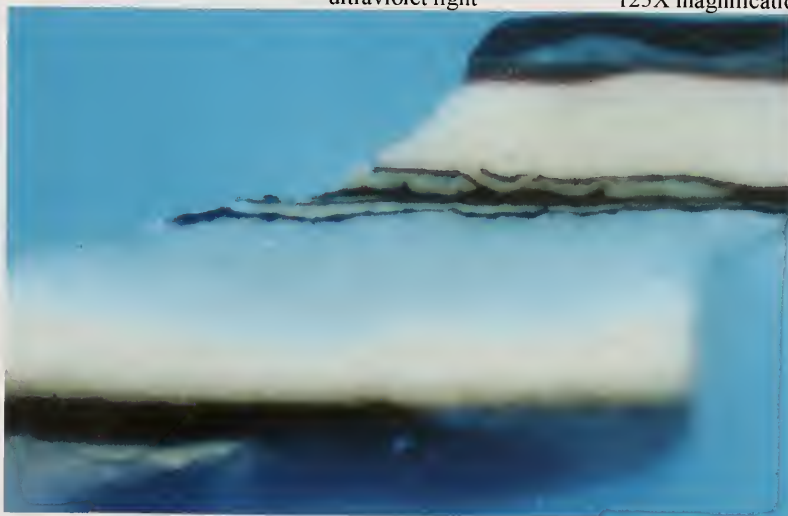


Figure F-18a.

Sample 25

first-floor northwest chamber, door architrave
reflected visible light

125X magnification



Figure F-18b.

Sample 25

first-floor northwest chamber, door architrave
ultraviolet light

125X magnification



Figure F-18c. Sample 25 first-floor northwest chamber, door architrave
FITC ultraviolet light 125X magnification



Figure F-18d. Sample 25 first-floor northwest chamber, door architrave
RHOB ultraviolet light 125X magnification

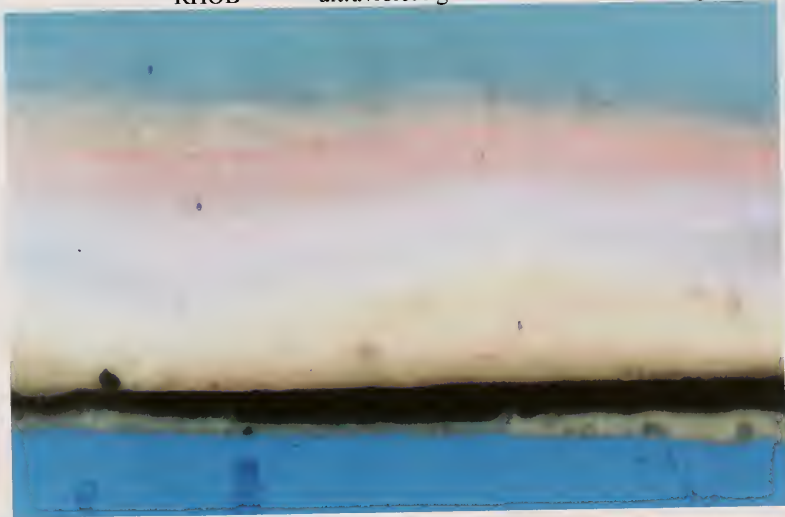


Figure F-19a. Sample 25 first-floor northwest chamber, door architrave
reflected visible light 125X magnification



Figure F-19b. Sample 25 first-floor northwest chamber, door architrave
ultraviolet light 125X magnification



Figure F-19c. Sample 25 first-floor northwest chamber, door architrave
 FITC ultraviolet light 125X magnification

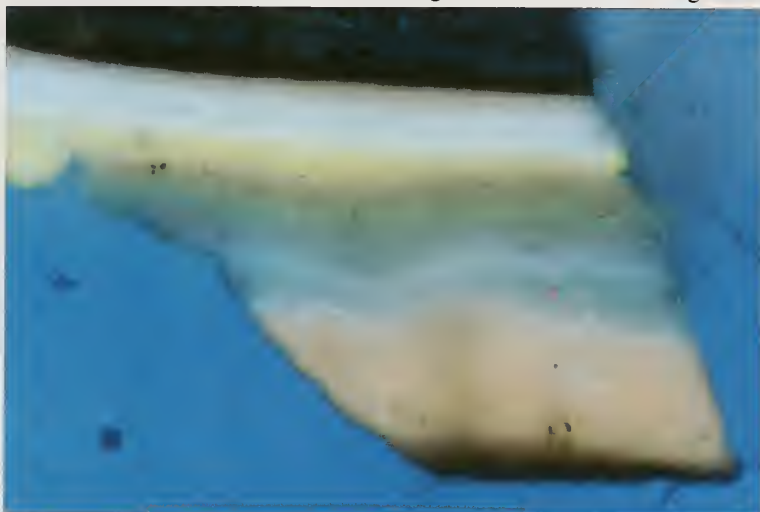


Figure F-19d. Sample 25 first-floor northwest chamber, door architrave
 RHOB ultraviolet light 125X magnification



Figure F-20a. Sample 88 first-floor northwest chamber, door architrave
reflected visible light 125X magnification



Figure F-20b. Sample 88 first-floor northwest chamber, door architrave
ultraviolet light 125X magnification



Figure F-20c. Sample 88 first-floor northwest chamber, door architrave
DCF ultraviolet light 125X magnification



Figure F-20d. Sample 88 first-floor northwest chamber, door architrave
FITC ultraviolet light 125X magnification



Figure F-21a. Sample 87 first-floor northwest chamber, door
reflected visible light 125X magnification



Figure F-21b. Sample 87 first-floor northwest chamber, door
ultraviolet light 125X magnification



Figure F-22a. Sample 87 first-floor northwest chamber, door
reflected visible light 250X magnification



Figure F-22b. Sample 87 first-floor northwest chamber, door
ultraviolet light 250X magnification



Figure F-23a. Sample 68 first-floor northwest chamber, surbase
reflected visible light 250X magnification



Figure F-23b. Sample 68 first-floor northwest chamber, surbase
ultraviolet light 250X magnification



Figure F-24a. Sample 69 first-floor northwest chamber, window panel
reflected visible light 250X magnification



Figure F-24b. Sample 69 first-floor northwest chamber, window panel
ultraviolet light 250X magnification



Figure F-25a. Sample 70 first-floor northwest chamber, surbase
ultraviolet light 250X magnification



Figure F-26a. Sample 30 first-floor northwest chamber, surbase
reflected visible light 250X magnification

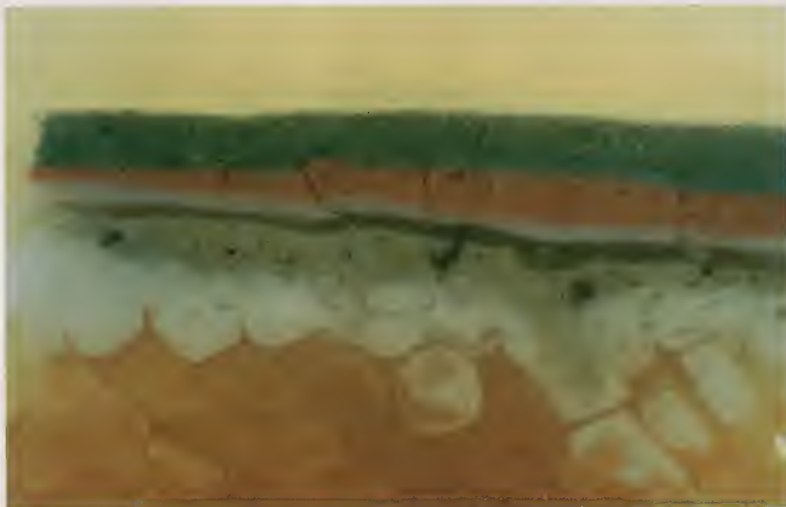


Figure F-26b. Sample 30 first-floor northwest chamber, surbase
ultraviolet light 250X magnification



Figure F-27a. Sample 47 drawing room, overmantel
reflected visible light 125X magnification

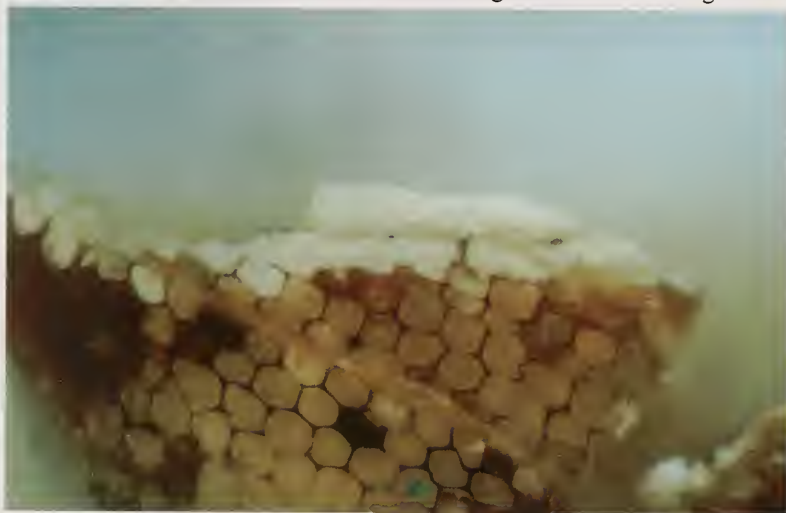


Figure F-27b. Sample 47 drawing room, overmantel
ultraviolet light 125X magnification

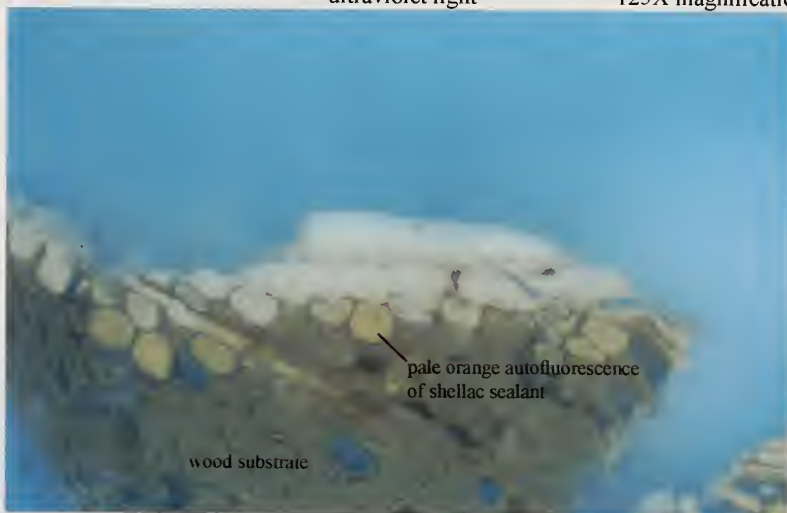


Figure F-27c.

Sample 47
DCF

drawing room, overmantel
ultraviolet light

125X magnification

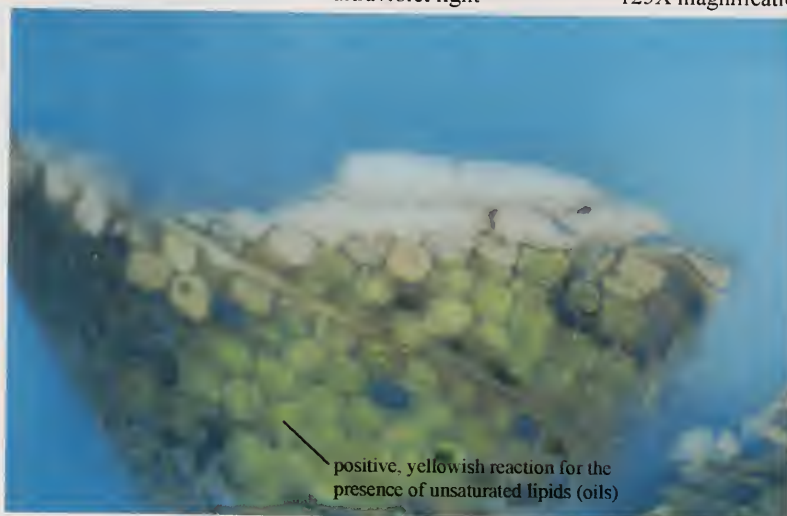


Figure F-27d. Sample 47 drawing room, overmantel
reflected visible light 250X magnification

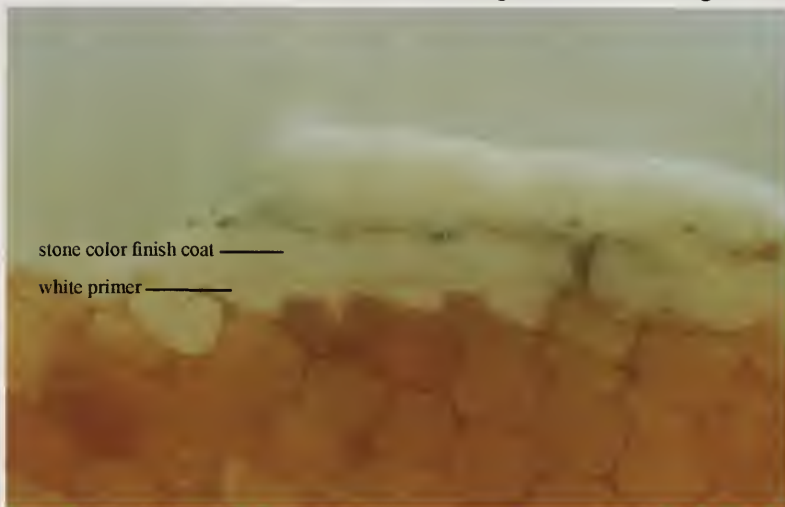


Figure F-27e. Sample 47 drawing room, overmantel
ultraviolet light 250X magnification



Figure F-28a. Sample 38 drawing room, surbase
reflected visible light 125X magnification



Figure F-28b. Sample 38 drawing room, surbase
reflected visible light 125X magnification



Figure F-29a. Sample 41 drawing room, baseboard
reflected visible light 125X magnification



Figure F-29b. Sample 41 drawing room, baseboard
ultraviolet light 125X magnification

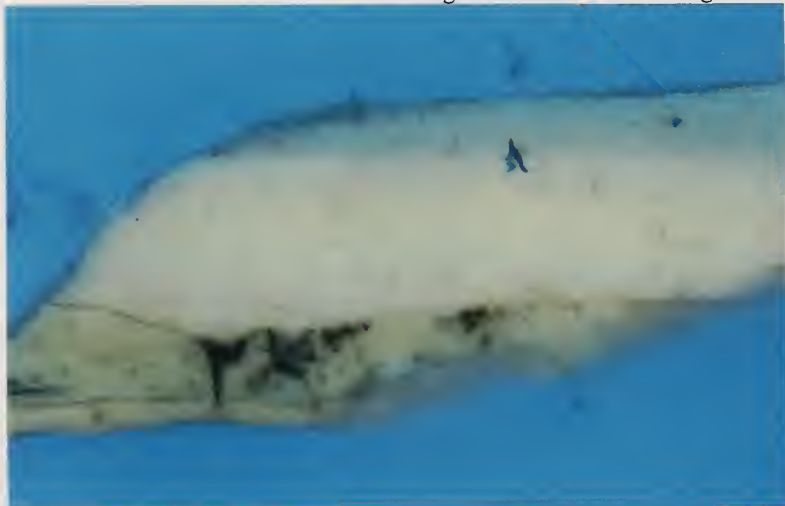


Figure F-30a. Sample 39 drawing room, wainscot
reflected visible light 125X magnification



Figure F-30b. Sample 39 drawing room, wainscot
ultraviolet light 125X magnification



Figure F-31a. Sample 77 drawing room, wainscot
reflected visible light 250X magnification



Figure F-31b. Sample 77 drawing room, wainscot
ultraviolet light 250X magnification



Figure F-32a. Sample 77 drawing room, wainscot
reflected visible light 250X magnification



Figure F-32b. Sample 77 drawing room, wainscot
ultraviolet light 250X magnification



Figure F-33a. Sample 77 drawing room, wainscot
reflected visible light 125X magnification



Figure F-33b. Sample 77 drawing room, wainscot
ultraviolet light 125X magnification



Figure F-34a. Sample 78 drawing room, wainscot
reflected visible light 125X magnification



Figure F-34b. Sample 78 drawing room, wainscot
ultraviolet light 125X magnification



Figure F-35a. Sample 76 drawing room, baseboard
reflected visible light 125X magnification

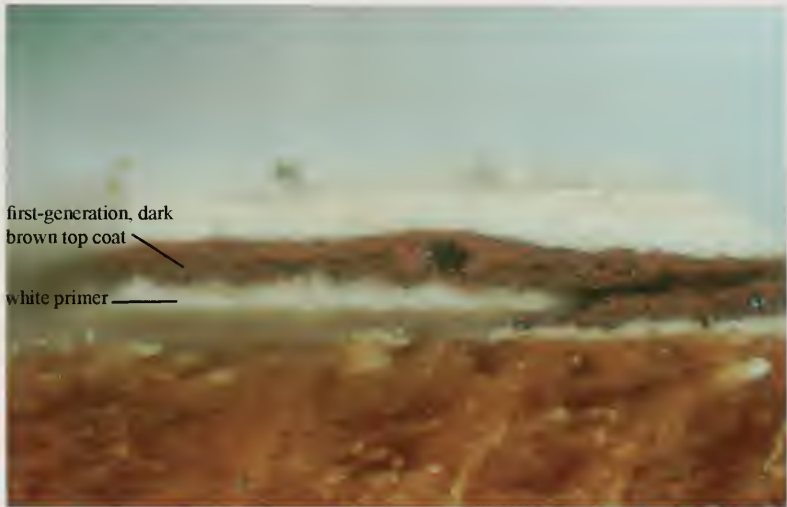


Figure F-35b. Sample 76 drawing room, wainscot
ultraviolet light 125X magnification

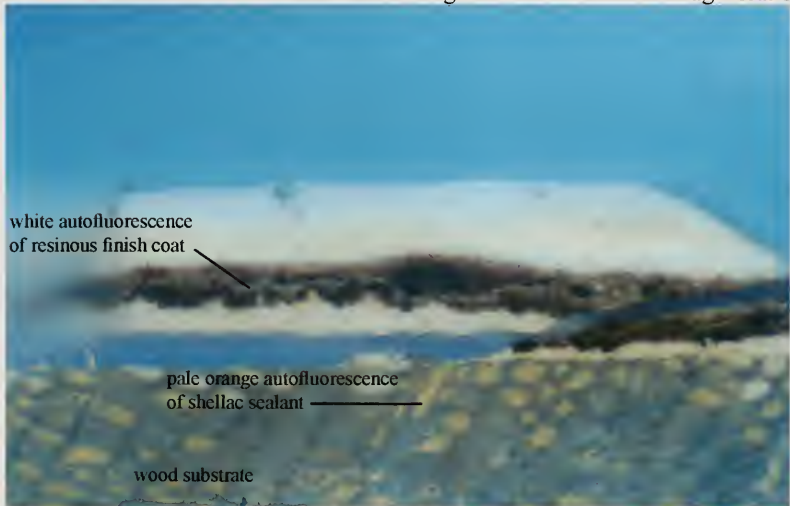


Figure F-36a. Sample 76 drawing room, baseboard
reflected visible light 250X magnification

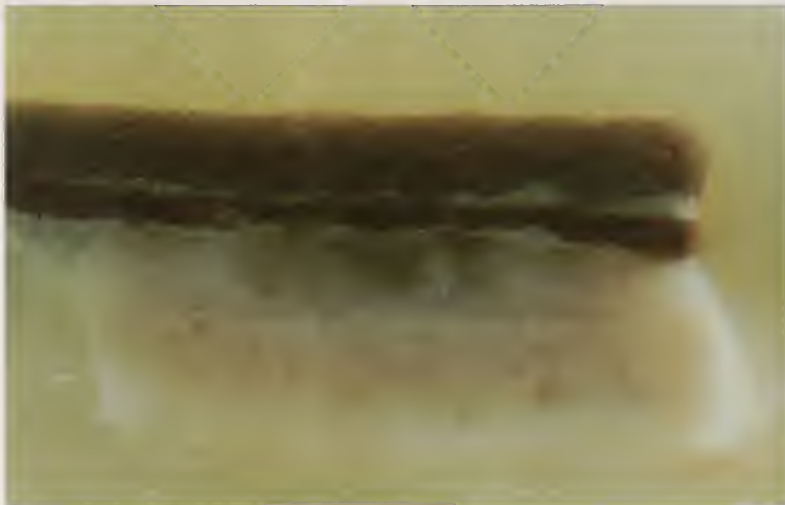


Figure F-36b. Sample 76 drawing room, baseboard
ultraviolet light 250X magnification



Figure F-37a. Sample 91 drawing room, plaster field
reflected visible light 50X magnification

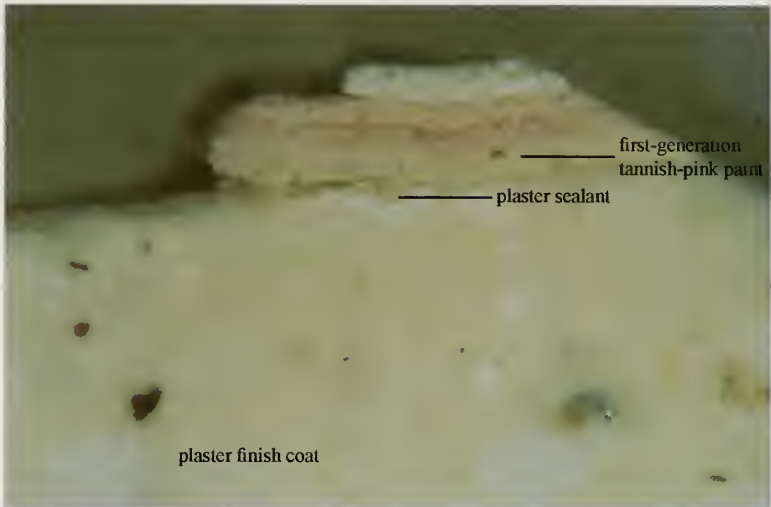


Figure F-37b. Sample 91 drawing room, plaster field
ultraviolet light 50X magnification



Figure F-37c.

Sample 91
TTC

drawing room, plaster field
ultraviolet light

50X magnification



Figure F-38a.

Sample 91

drawing room, plaster field
reflected visible light

50X magnification



Figure F-38b.

Sample 91

drawing room, plaster field
ultraviolet light

50X magnification



Figure F-39a. Sample 73 drawing room, plaster field
reflected visible light 50X magnification



Figure F-39b. Sample 73 drawing room, plaster field
ultraviolet light 50X magnification



Figure F-40a. Sample 32 drawing room, plaster field
reflected visible light 125X magnification



Figure F-40b. Sample 32 drawing room, plaster field
ultraviolet light 125X magnification



Figure F-41a. Sample 53 drawing room, door
reflected visible light 125X magnification



Figure F-41b. Sample 53 drawing room, door
ultraviolet light 125X magnification

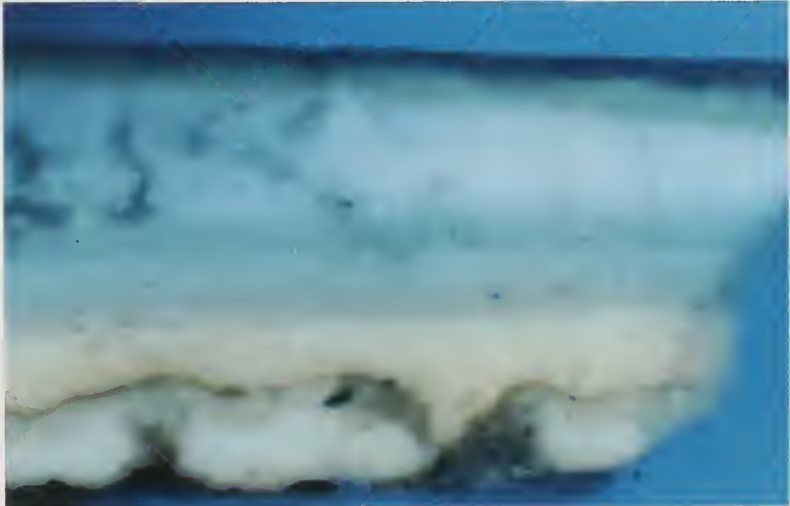


Figure F-42a. Sample 81 second-floor southeast chamber, paneling
reflected visible light 250X magnification

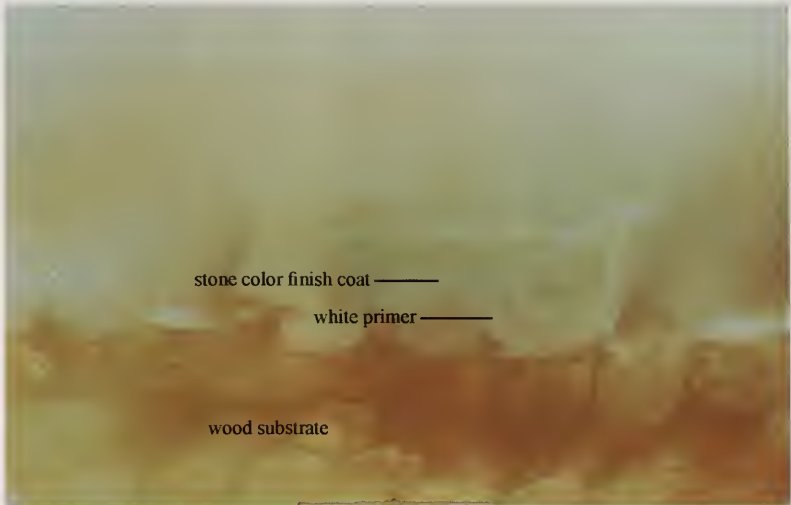


Figure F-42b. Sample 81 second-floor southeast chamber, paneling
ultraviolet light 250X magnification



Figure F-43a. Sample 90 second-floor southeast chamber, door
reflected visible light 125X magnification



Figure F-43b. Sample 90 second-floor southeast chamber, door
ultraviolet light 125X magnification



Figure F-43c. Sample 90 second-floor southeast chamber, door
DCF ultraviolet light 125X magnification

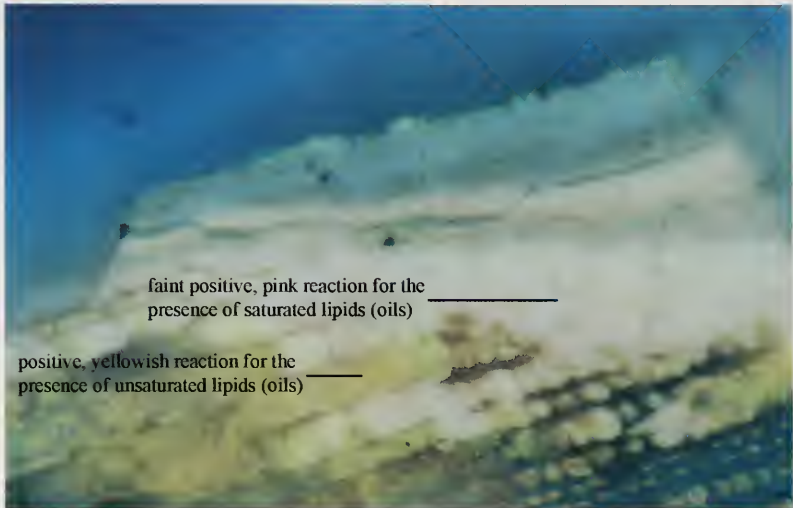


Figure F-44a. Sample 56 second-floor southeast chamber, surbase
reflected visible light 125X magnification

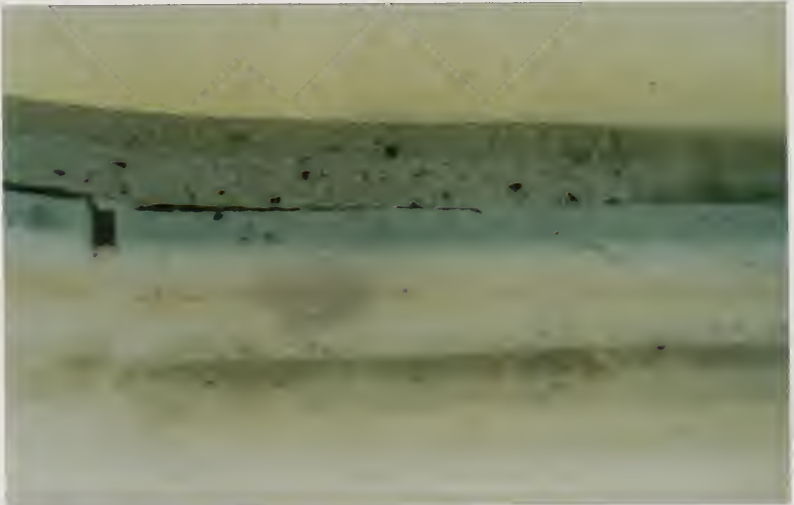


Figure F-44b. Sample 56 second-floor southeast chamber, surbase
ultraviolet light 125X magnification



Figure F-45a. Sample 60 second-floor southeast chamber, panel
reflected visible light 125X magnification

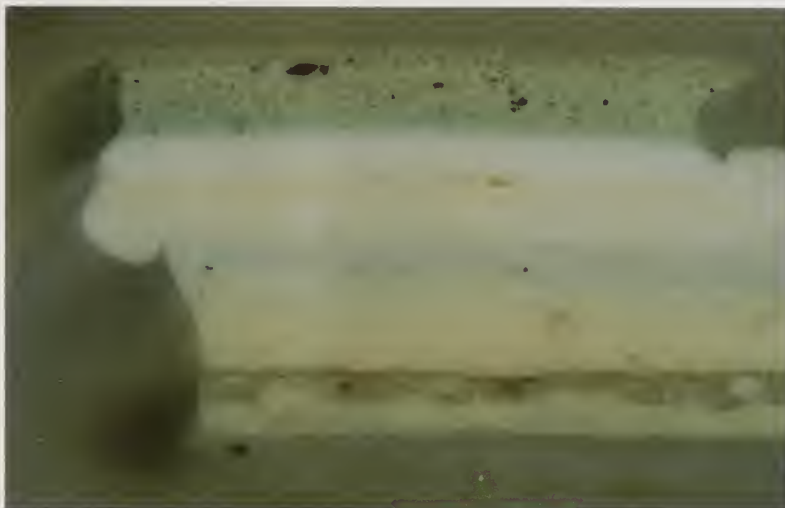


Figure F-45b. Sample 60 second-floor southeast chamber, panel
ultraviolet light 125X magnification

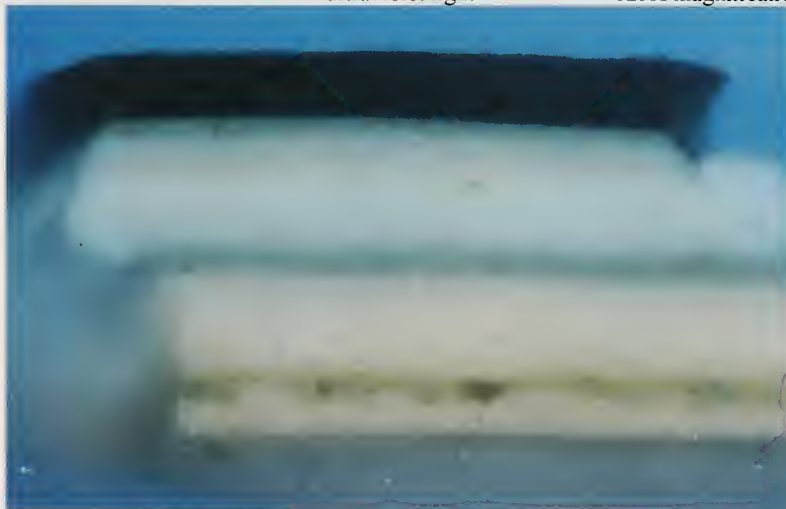


Figure F-45c.

Sample 60
DCF

second-floor southeast chamber, panel
ultraviolet light 125X magnification

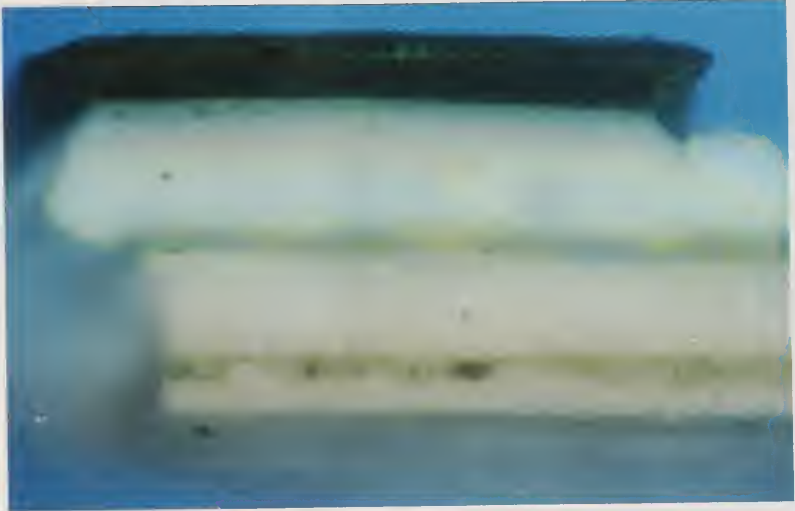


Figure F-46a. Sample 97 second-floor southeast chamber, crown molding
reflected visible light 250X magnification

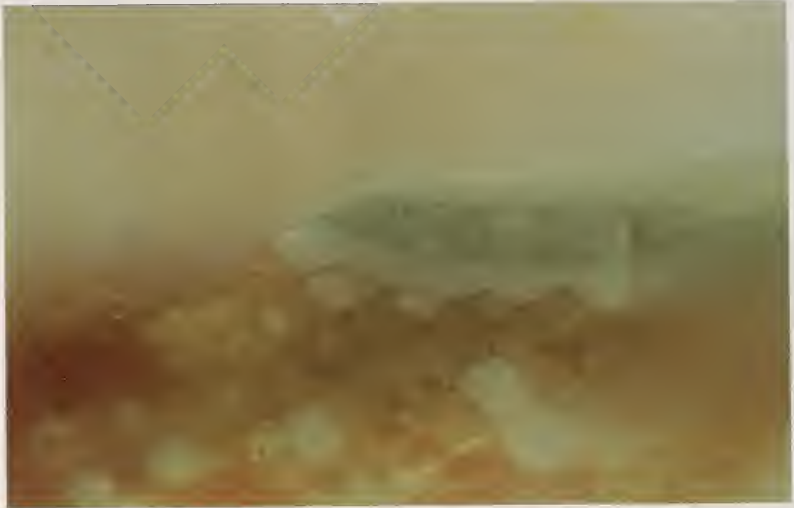


Figure F-46b. Sample 97 second-floor southeast chamber, crown molding
ultraviolet light 250X magnification



Figure F-47a. Sample 82 second-floor southeast chamber, baseboard
reflected visible light 125X magnification



Figure F-47b. Sample 82 second-floor southeast chamber, baseboard
ultraviolet light 125X magnification



Figure F-48a. Sample 55 second-floor southeast chamber, baseboard
reflected visible light 250X magnification



Figure F-48b. Sample 55 second-floor southeast chamber, baseboard
ultraviolet light 250X magnification



Figure F-49a. Sample 55 second-floor southeast chamber, baseboard
reflected visible light 125X magnification

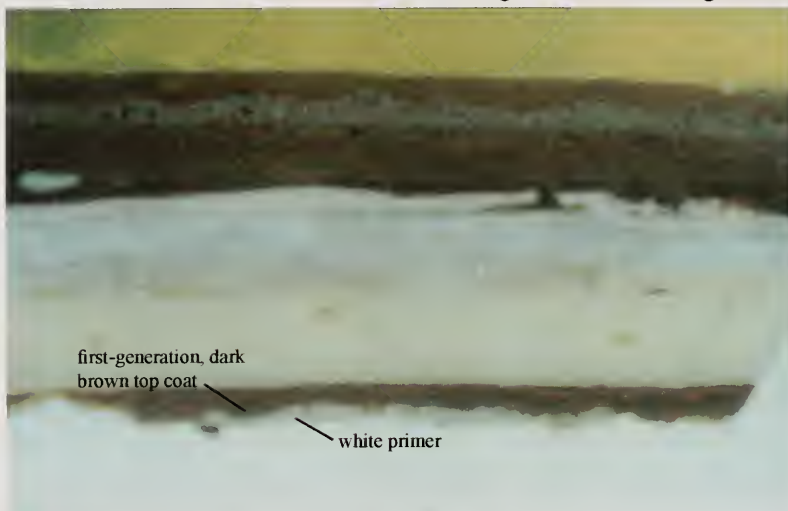


Figure F-49b. Sample 55 second-floor southeast chamber, baseboard
ultraviolet light 125X magnification

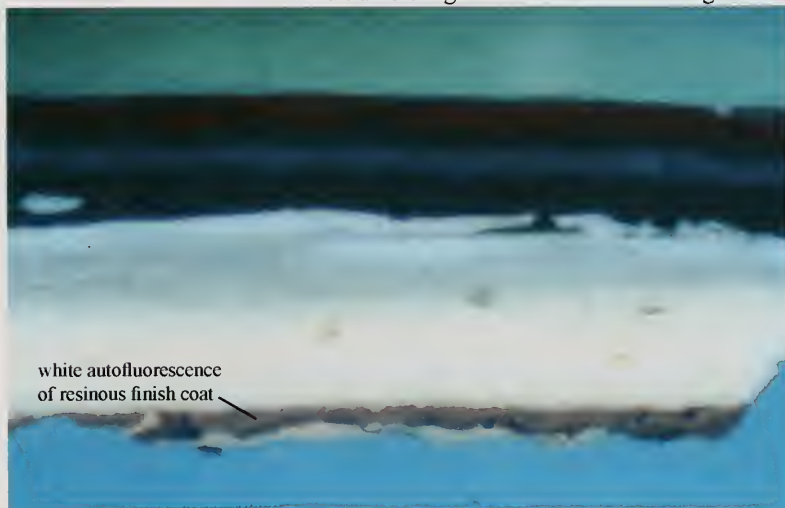


Figure F-50a. Sample 80 second-floor southeast chamber, baseboard
reflected visible light 125X magnification



Figure F-50b. Sample 80 second-floor southeast chamber, baseboard
ultraviolet light 125X magnification



Figure F-51a. Sample 80 second-floor southeast chamber, baseboard
reflected visible light 125X magnification

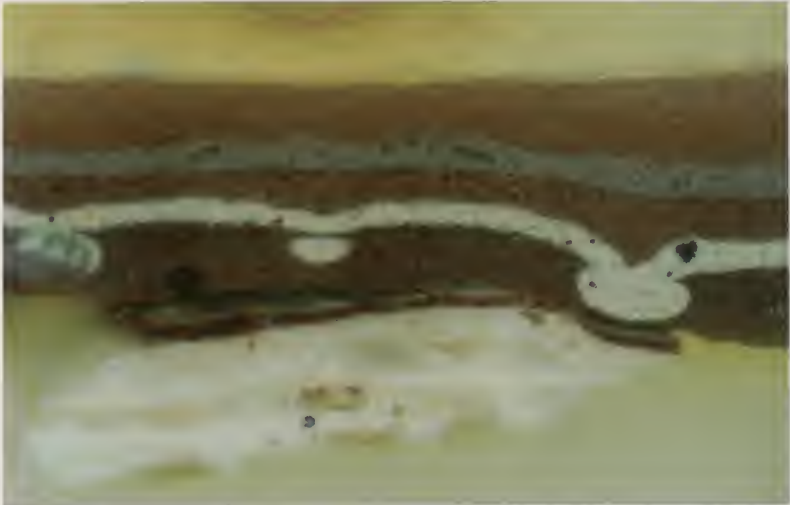


Figure F-51b. Sample 80 second-floor southeast chamber, baseboard
ultraviolet light 125X magnification

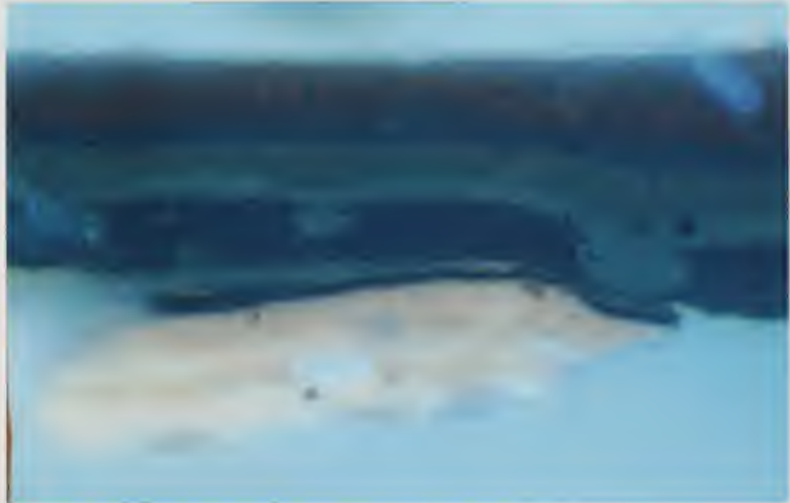


Figure F-52a. Sample 104 second-floor southeast chamber, plaster wall
reflected visible light 50X magnification

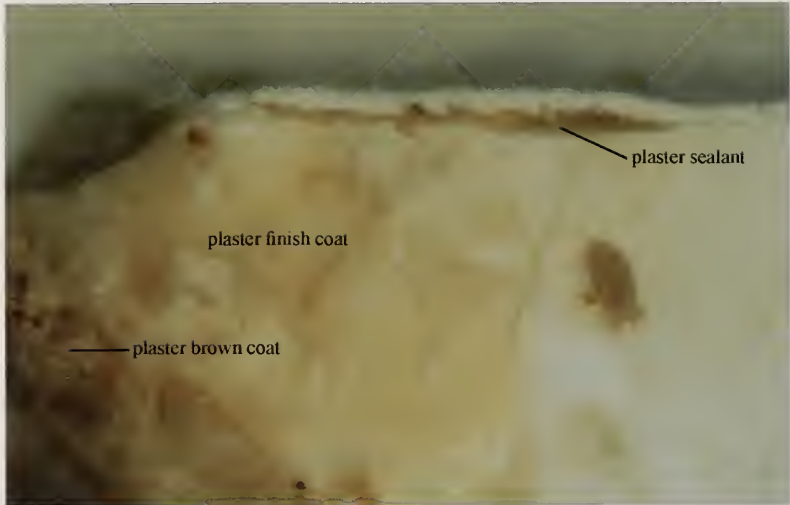


Figure F-52b. Sample 104 second-floor southeast chamber, plaster wall
ultraviolet light 50X magnification



Figure F-52c. Sample 104 second-floor southeast chamber, plaster wall
reflected visible light 125X magnification



Figure F-52d. Sample 104 second-floor southeast chamber, plaster wall
ultraviolet light 125X magnification



Figure F-52e. Sample 104 second-floor southeast chamber, plaster wall
TTC ultraviolet light 125X magnification



Figure F-52f. Sample 104 second-floor southeast chamber, plaster wall
TSQ ultraviolet light 125X magnification



Figure F-53a. Sample 104 second-floor southeast chamber, plaster wall
reflected visible light 125X magnification



Figure F-53b. Sample 104 second-floor southeast chamber, plaster wall
ultraviolet light 125X magnification

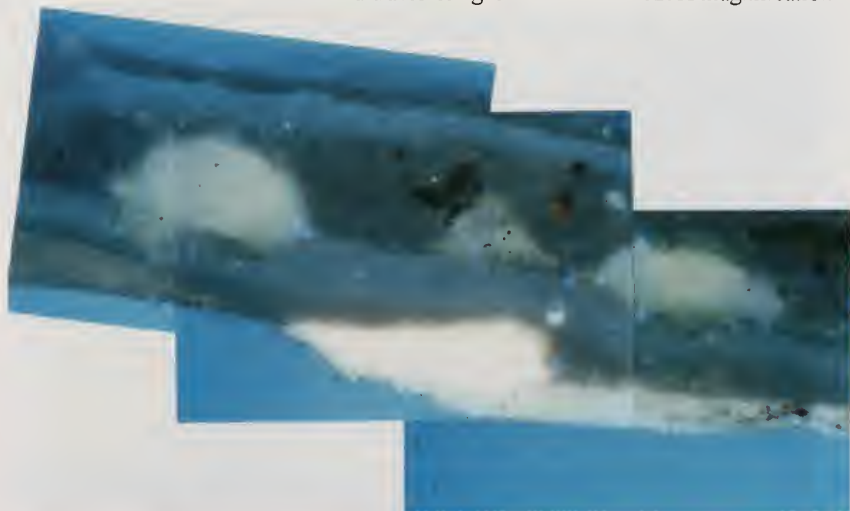


Figure G-1a. Sample 88 dispersed pigment sample for PLM.
transmitted visible light, 500X magnification

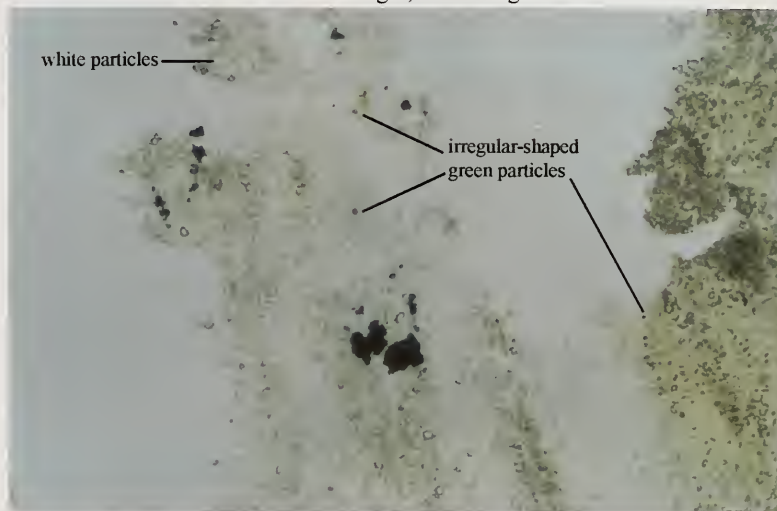


Figure G-1b. Sample 88 dispersed pigment sample for PLM.
crossed polars, 500X magnification

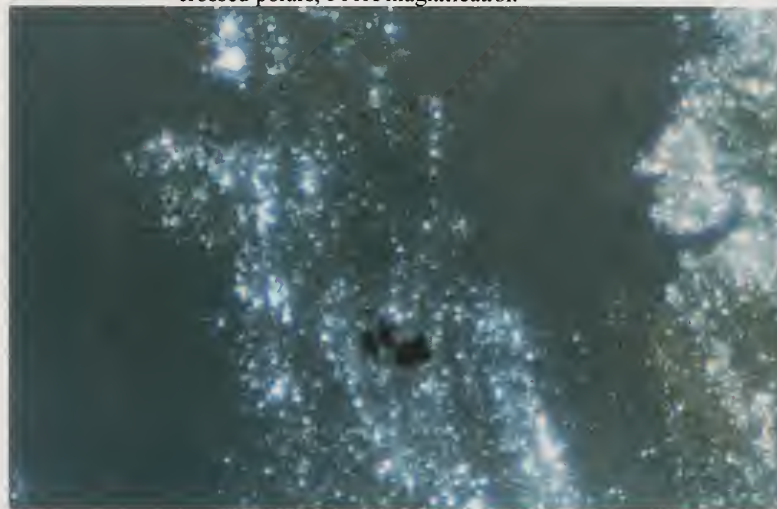
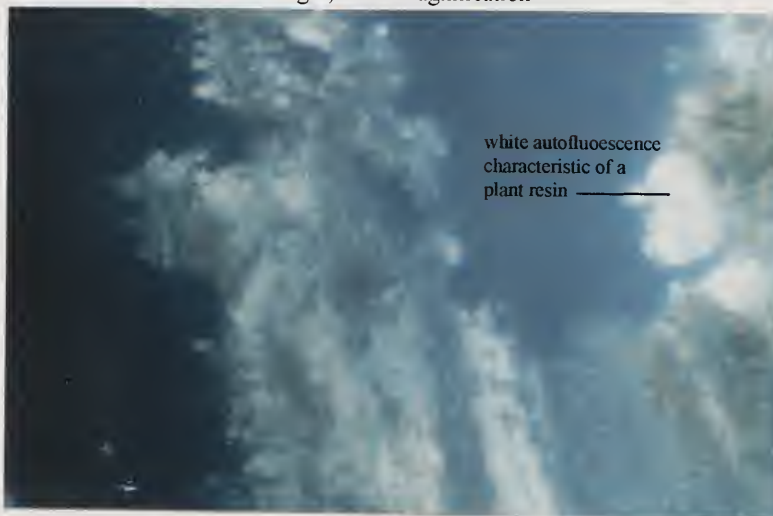


Figure G-1c. Sample 88 dispersed pigment sample for PLM.
ultraviolet light, 500X magnification



APPENDIX H

Figure H-1a.

Sample 9
FTIR spectrum

parlor, surbase
first generation paint

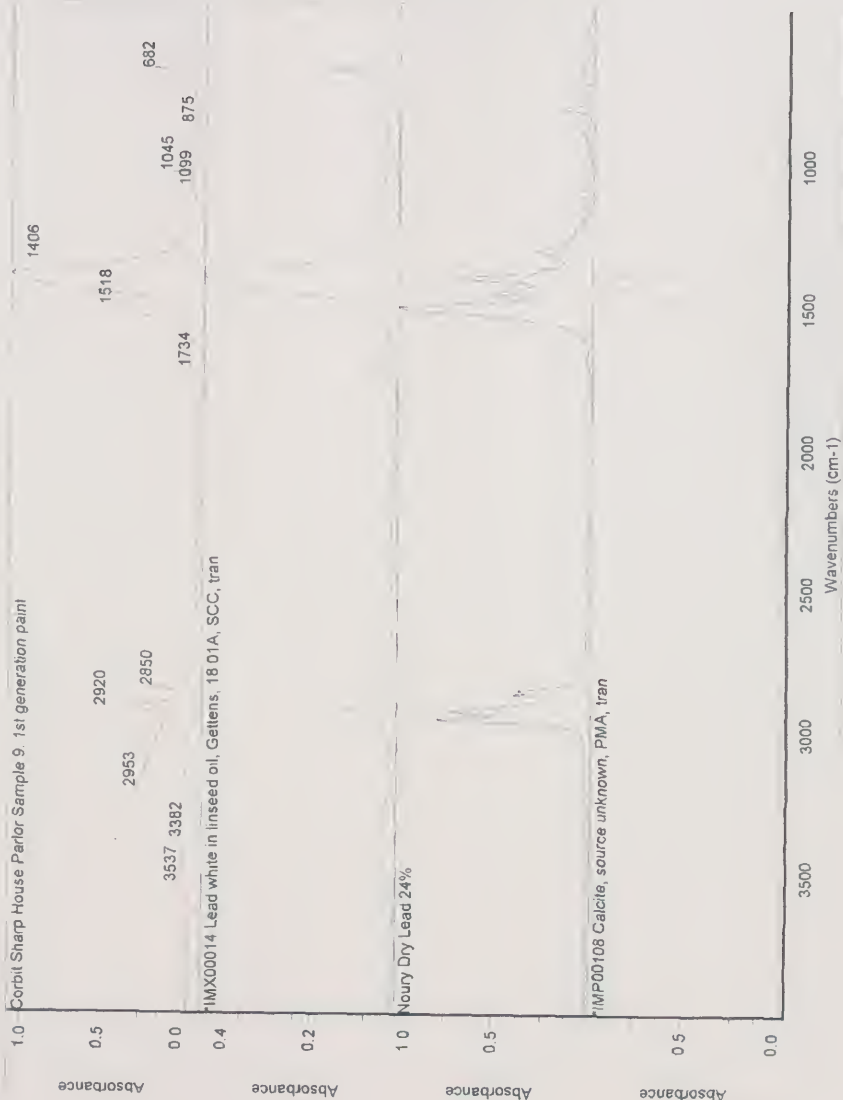


Figure H-1b.

Sample 9
FTIR spectrumparlor, surbase
fifth generation paint

APPENDIX H

Figure H-2a.

Sample 85
FTIR spectrum

parlor, baseboard
first generation paint



APPENDIX H

Figure H-2b.

Sample 85
FTIR spectrum

parlor, baseboard
first generation paint



Figure H-3a.

Sample 100
FTIR spectrumparlor, plaster wall
plaster substrate

APPENDIX H

Figure H-3b.

Sample 100
FTIR spectrum

parlor, plaster wall
plaster surface

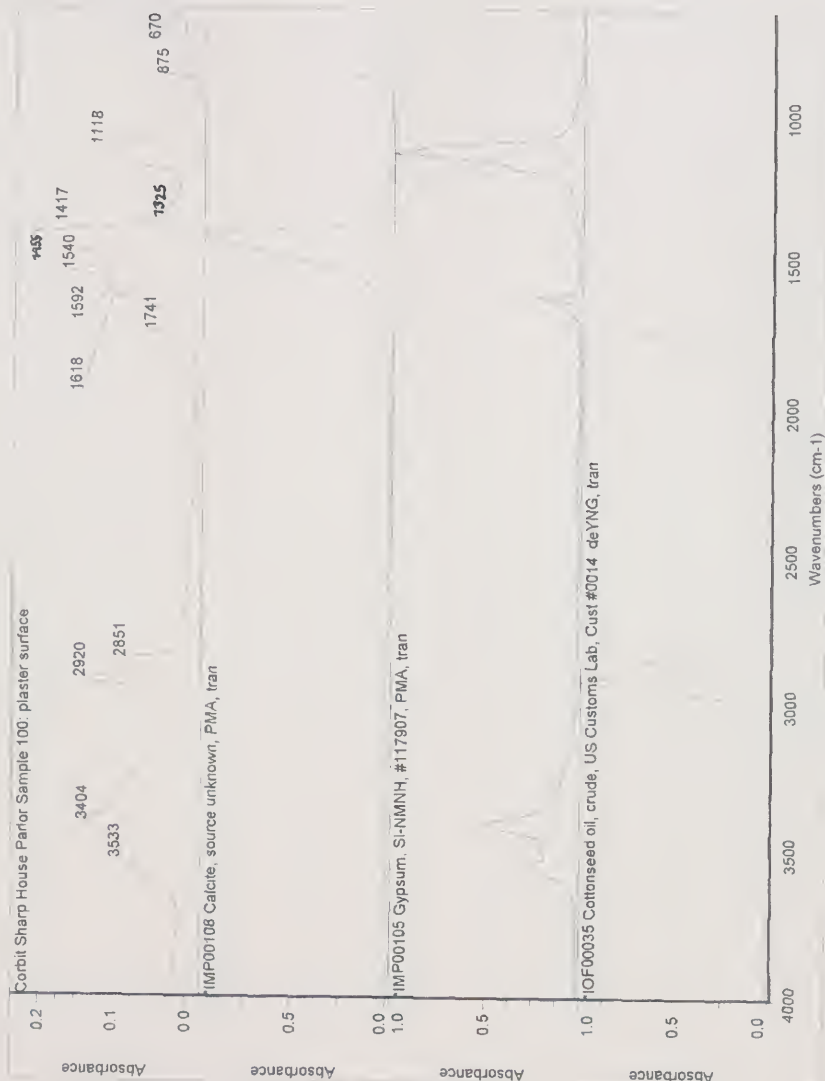


Figure H-3c.

Sample 100
FTIR spectrumparlor, plaster wall
first generation paint

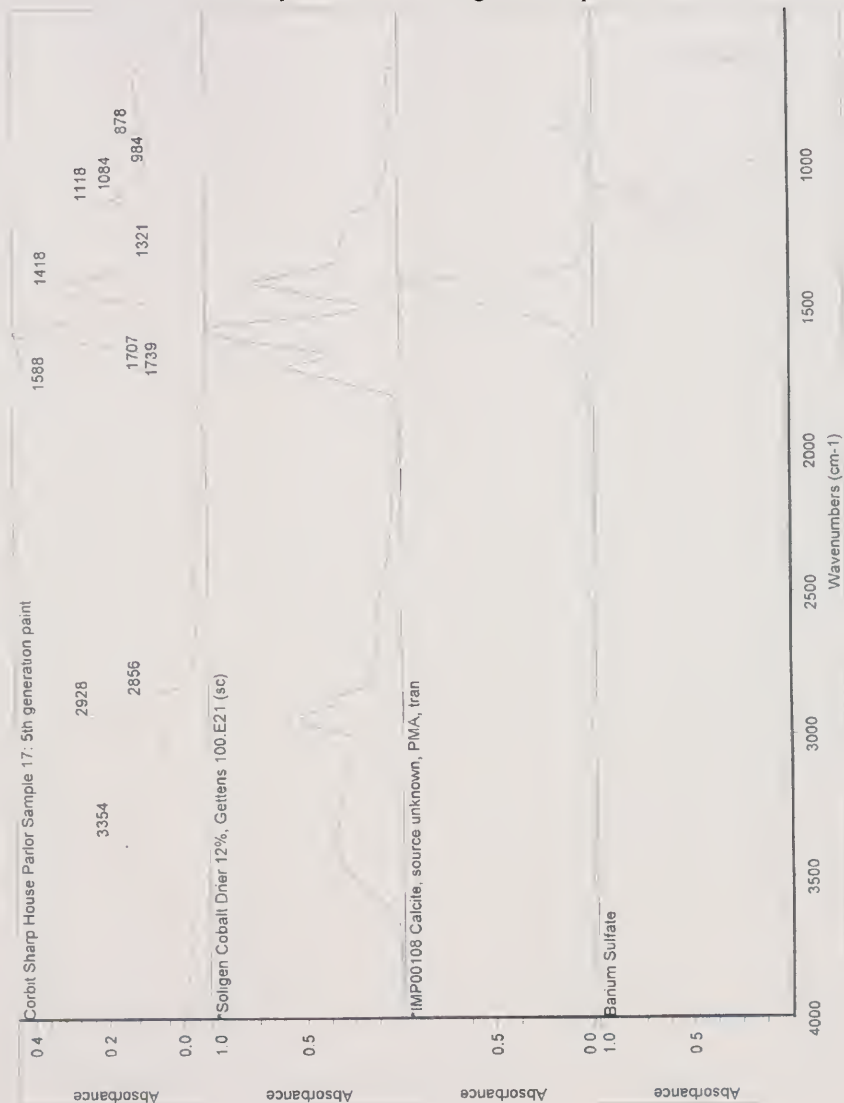
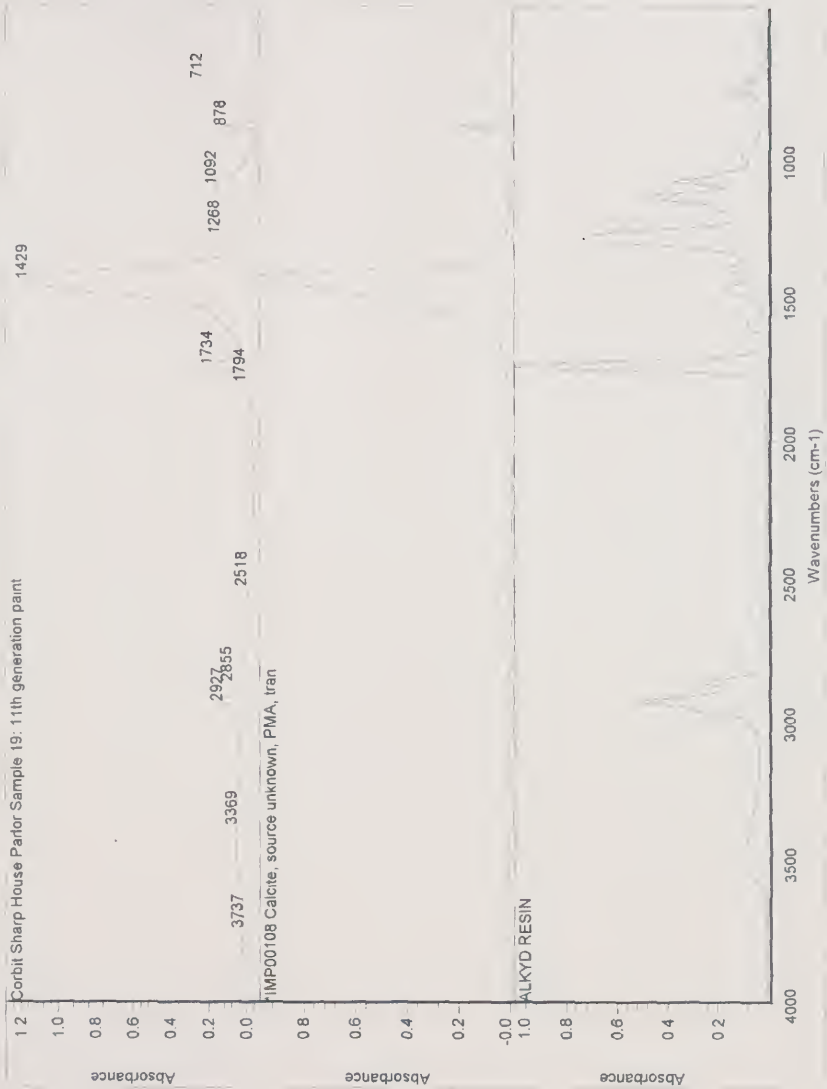
Figure H-4Sample 17
FTIR spectrumparlor, door pediment
fifth generation paint

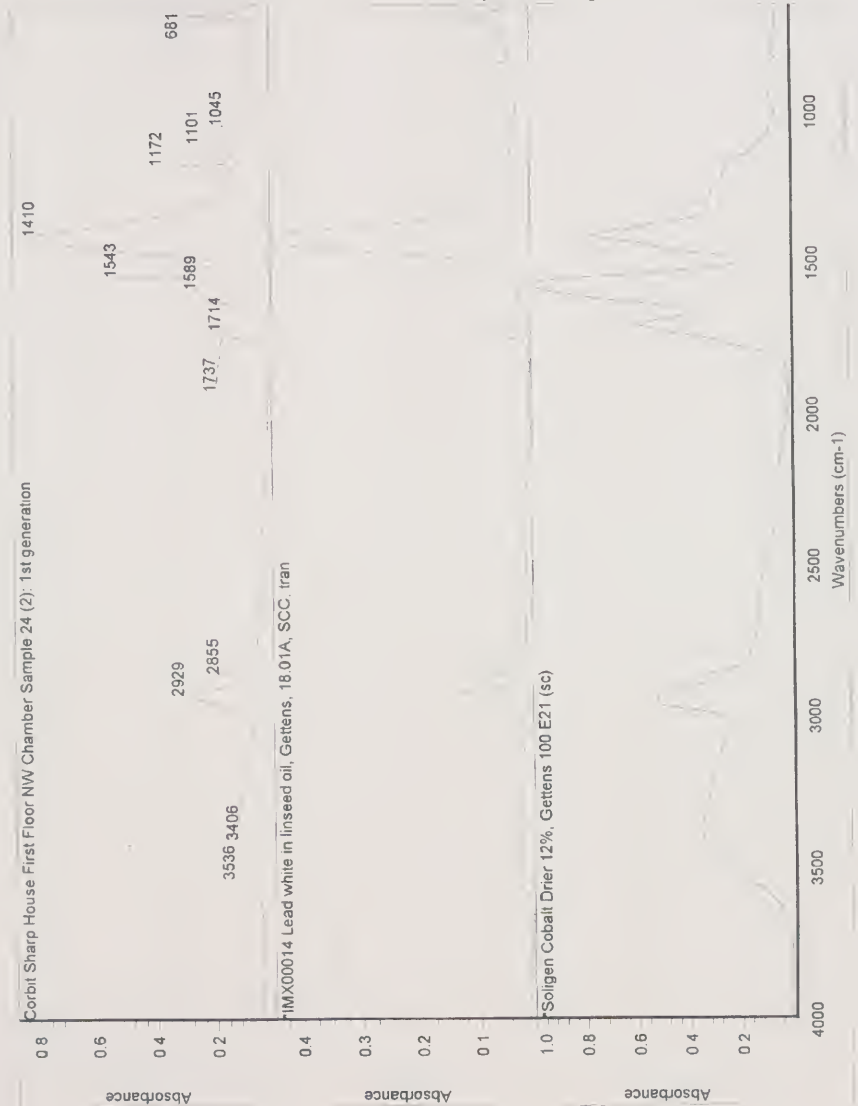
Figure H-5Sample 19
FTIR spectrumparlor, door architrave
eleventh generation paint

APPENDIX H

Figure H-6a.

Sample 24
FTIR spectrum

first-floor northwest chamber, closet door
first-generation green finish



APPENDIX H

Figure H-6b.

Sample 24
FTIR spectrum

first-floor northwest chamber, closet door
first-generation green finish

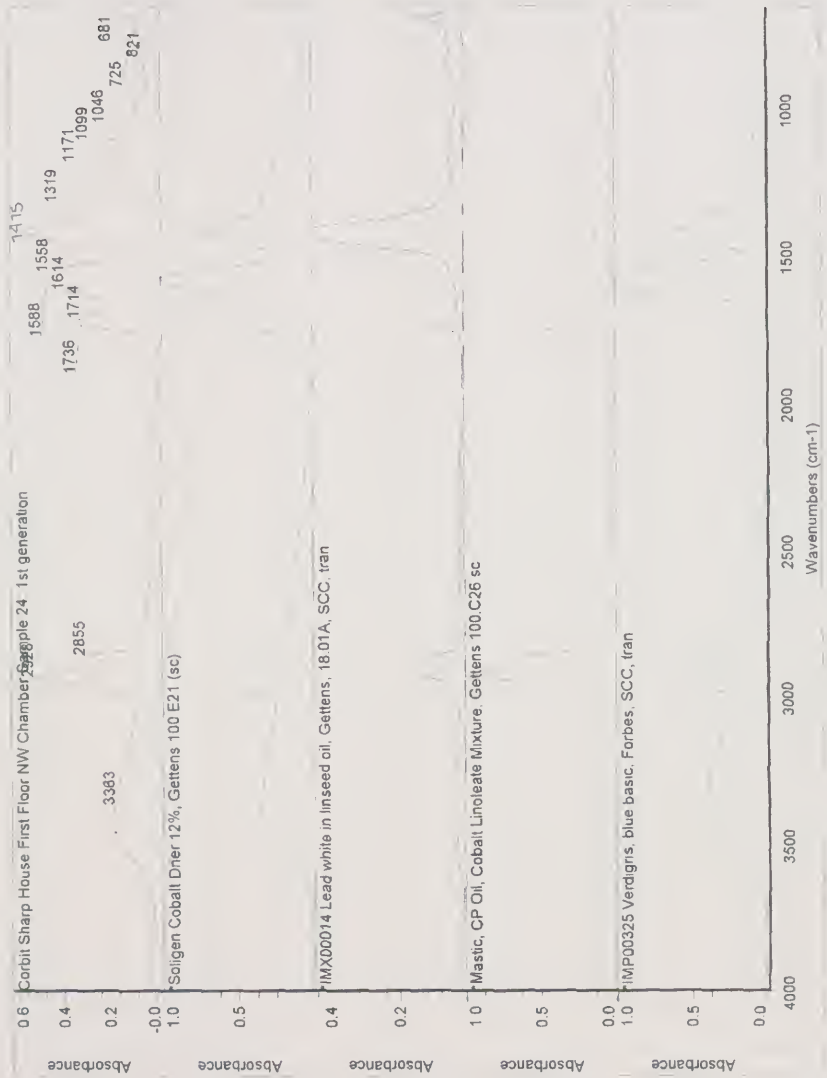
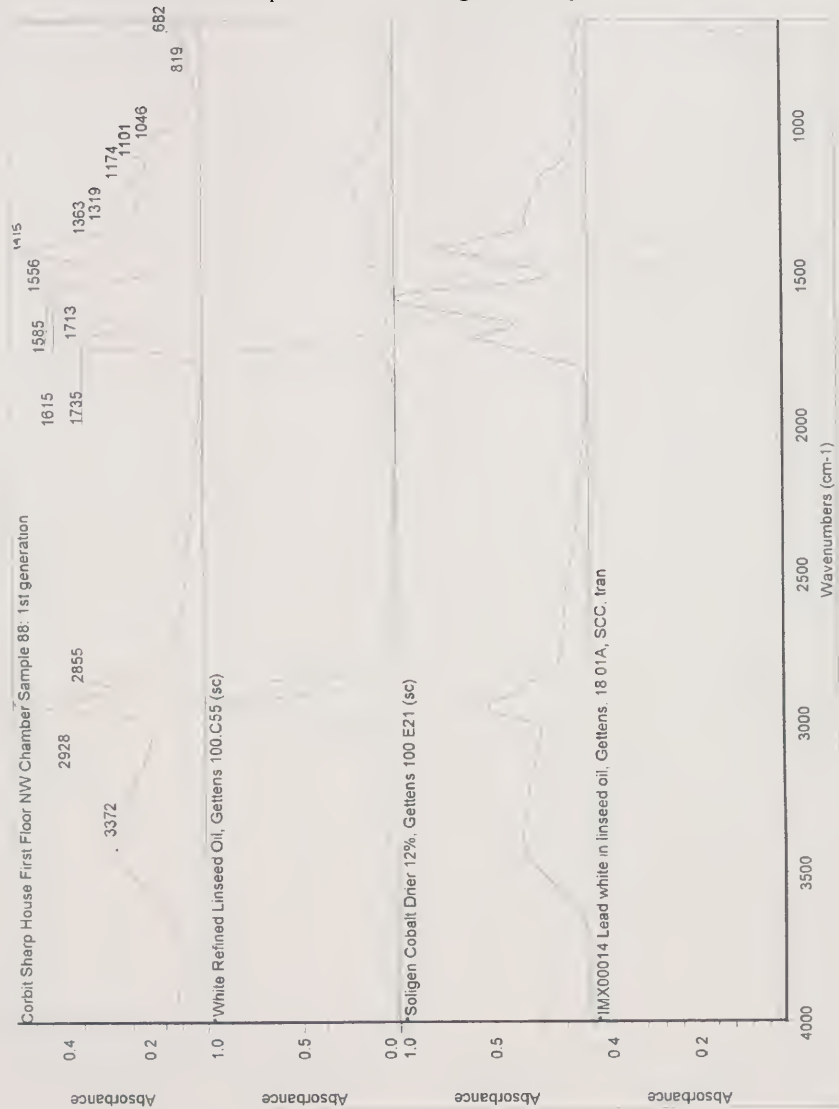


Figure H-7a.

Sample 88
FTIR spectrum

first-floor northwest chamber, door architrave
first-generation green finish



APPENDIX H

Figure H-7b.

Sample 88
FTIR spectrum

first-floor northwest chamber, door architrave
first-generation green finish

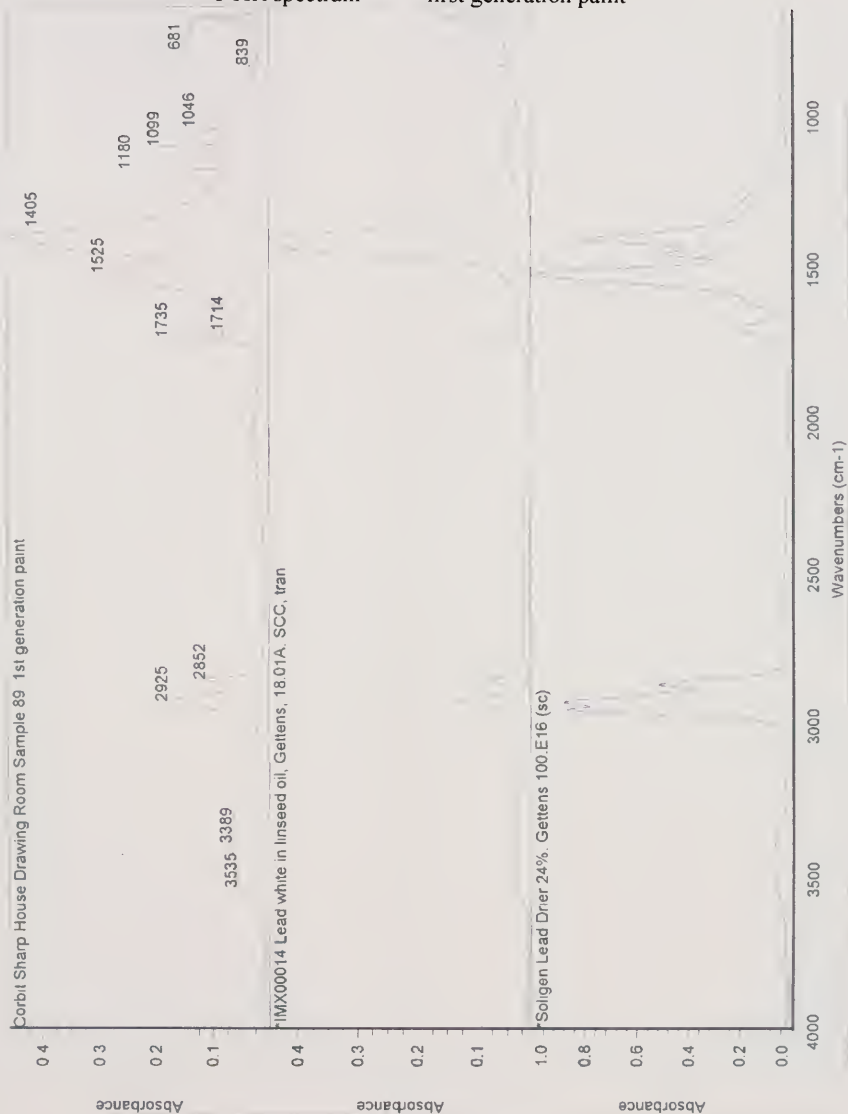


APPENDIX H

Figure H-8

Sample 89
FTIR spectrum

drawing room, door architrave
first generation paint



APPENDIX H

Figure H-9a.

Sample 91
FTIR spectrum

drawing room, plaster field
first generation paint

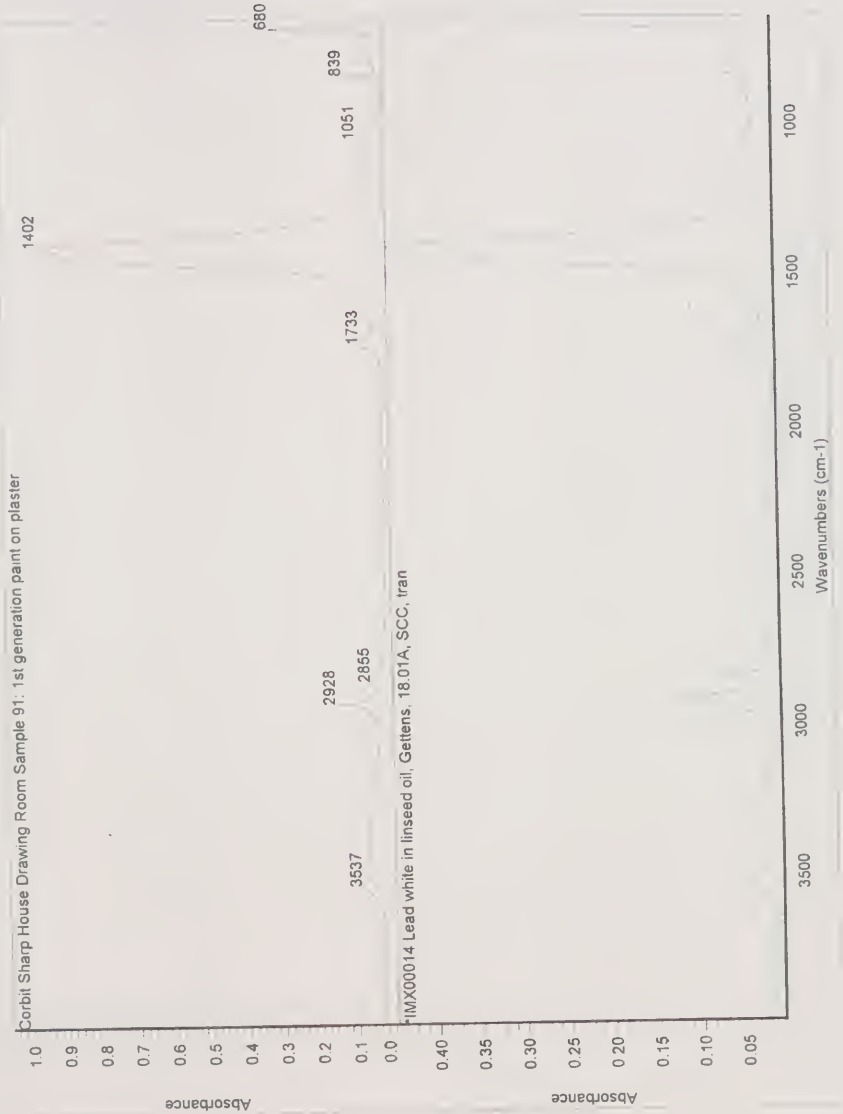
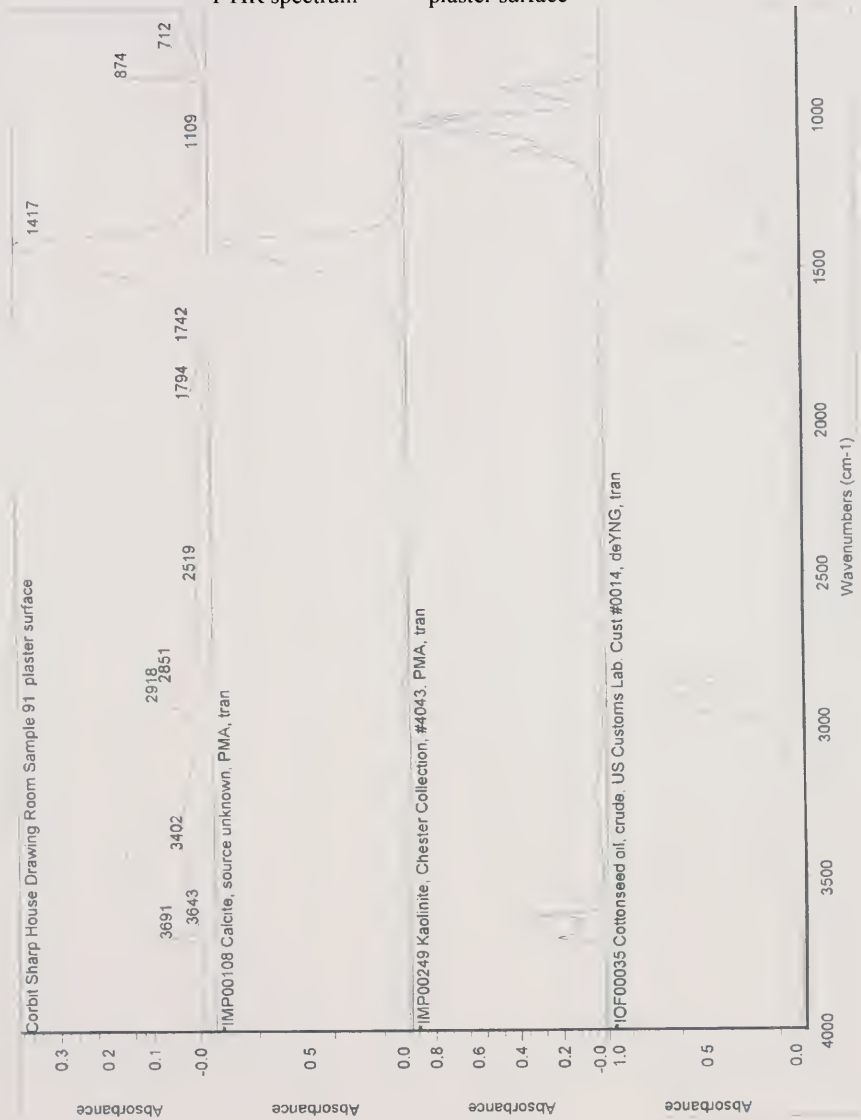


Figure H-9b.

Sample 91
FTIR spectrum

drawing room, plaster field
plaster surface



APPENDIX H

Figure H-9c.

Sample 91
FTIR spectrum

drawing room, plaster field
plaster sealant

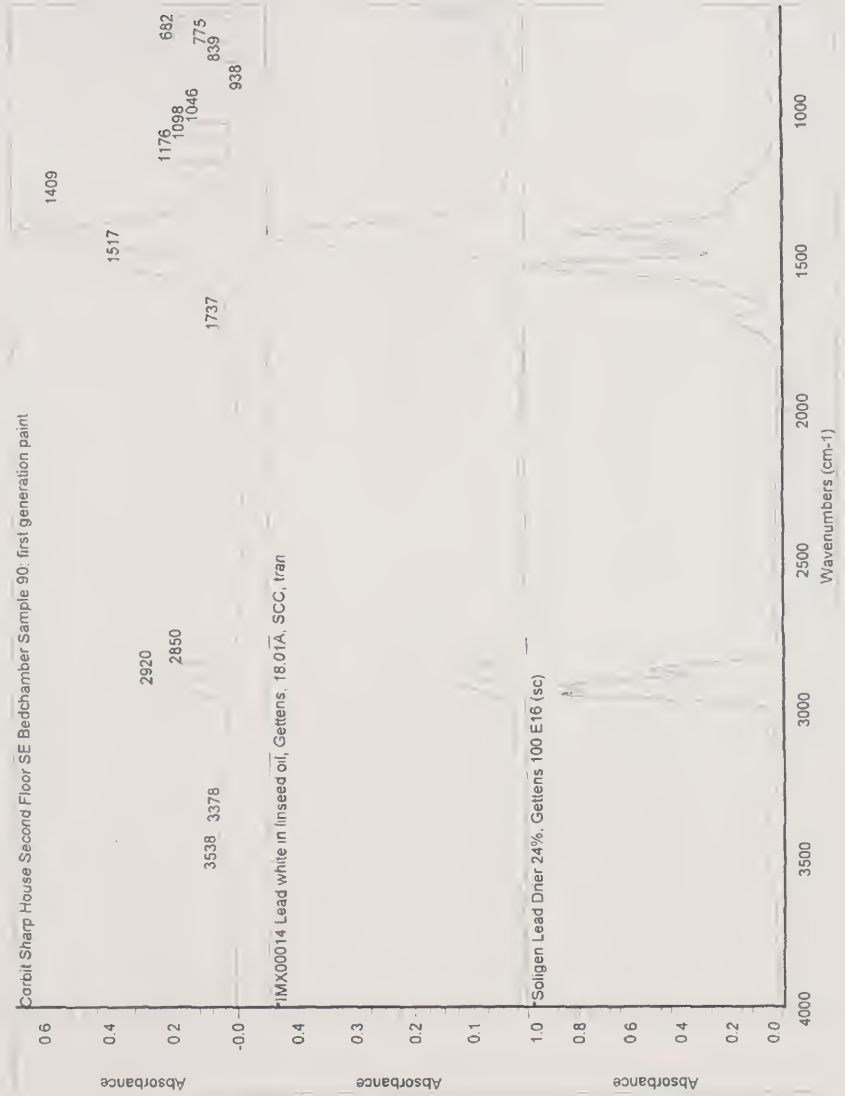


APPENDIX H

Figure H-10

Sample 90
FTIR spectrum

second-floor southeast chamber, door
first generation paint

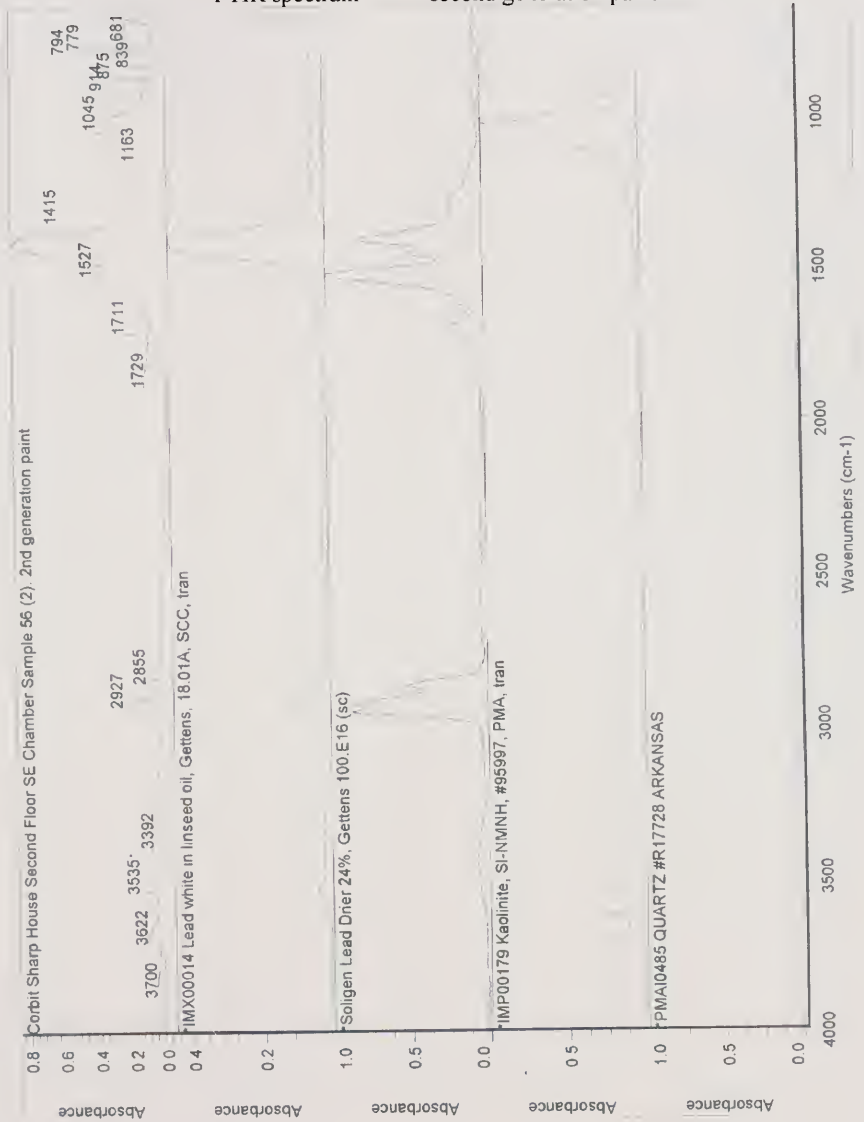


APPENDIX H

Figure H-11a.

Sample 56
FTIR spectrum

second-floor southeast chamber, surbase
second generation paint



APPENDIX H

Figure H-11b.

Sample 56
FTIR spectrum

second-floor southeast chamber, surbase
second generation paint

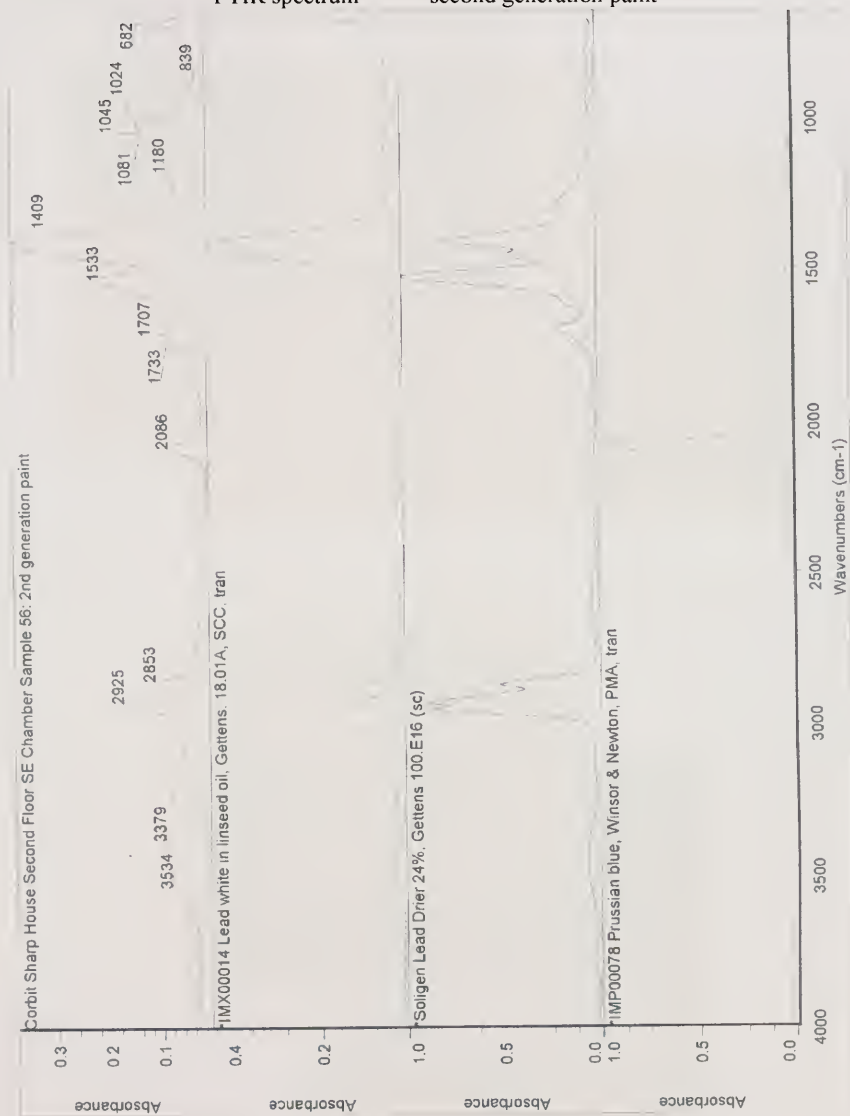


Figure I-1a. Sample 61 parlor, overmantel
cross-section photomicrograph reflected visible light 125X



Figure I-1b. Sample 61 parlor, overmantel
SEM backscatter electron image 174X magnification

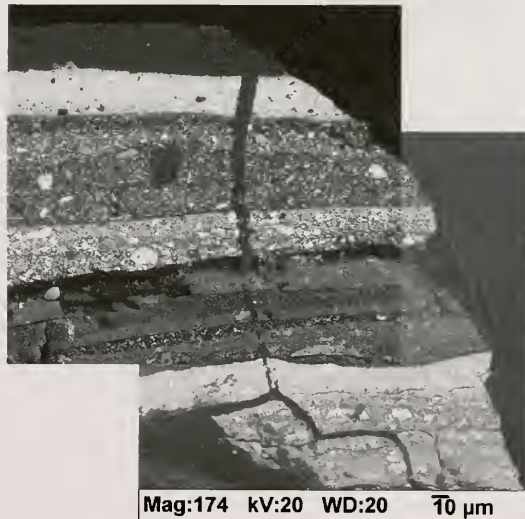


Figure I-1c.

Sample 61 parlor, overmantel
SEM-EDS elemental mapping 174X magnification

red = lead
green = zinc
blue = barium / titanium
pink = calcium

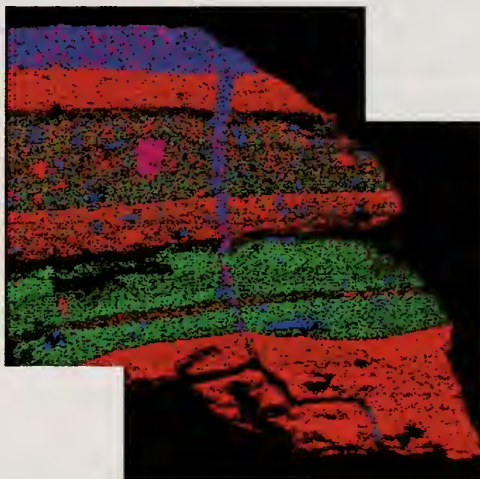


Figure I-1d. Sample 61 parlor, overmantel
SEM-EDS elemental spot analysis, fifth generation paint

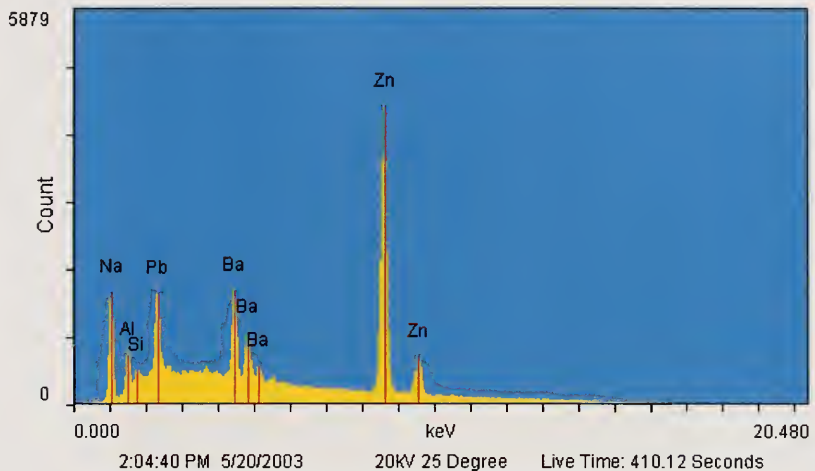


Figure I-1e. Sample 61 parlor, overmantel
SEM-EDS elemental spot analysis, eleventh generation paint

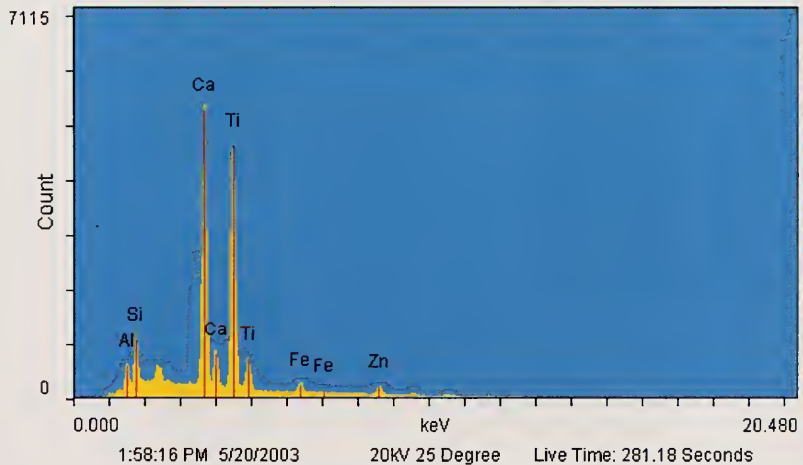


Figure I-2a.

Sample 13 parlor, baseboard
cross-section photomicrograph reflected visible light 125X



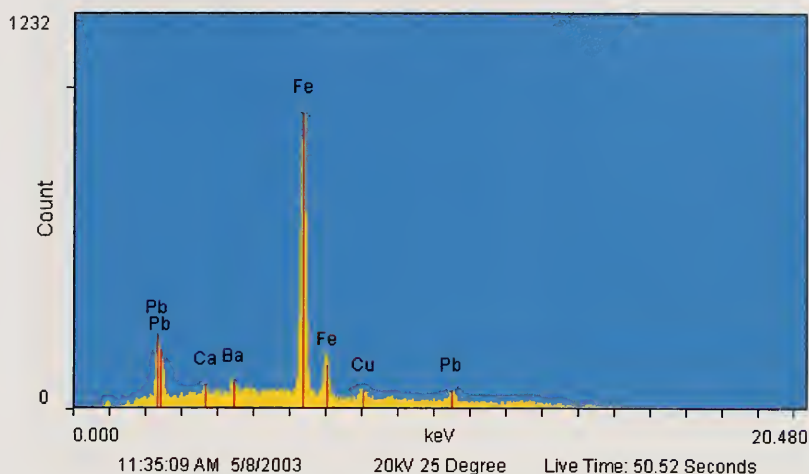
Figure I-2b.

Sample 13 parlor, baseboard
SEM backscatter electron image 243X magnification



Mag:243 kV:20 WD:20 10 µm

Figure I-2c. Sample 13 parlor, baseboard
SEM-EDS elemental spot analysis, first generation paint

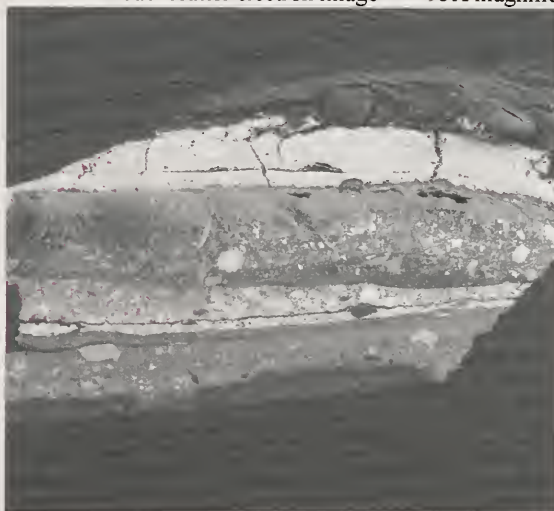


APPENDIX I

Figure I-3a. Sample 100 parlor, plaster wall
cross-section photomicrograph reflected visible light 125X



Figure I-3b. Sample 100 parlor, plaster wall
SEM backscatter electron image 93X magnification



Mag:93 kV:20 WD:20 100 μ m

Figure I-3c. Sample 100 parlor, plaster wall
SEM-EDS elemental spot analysis, first generation paint

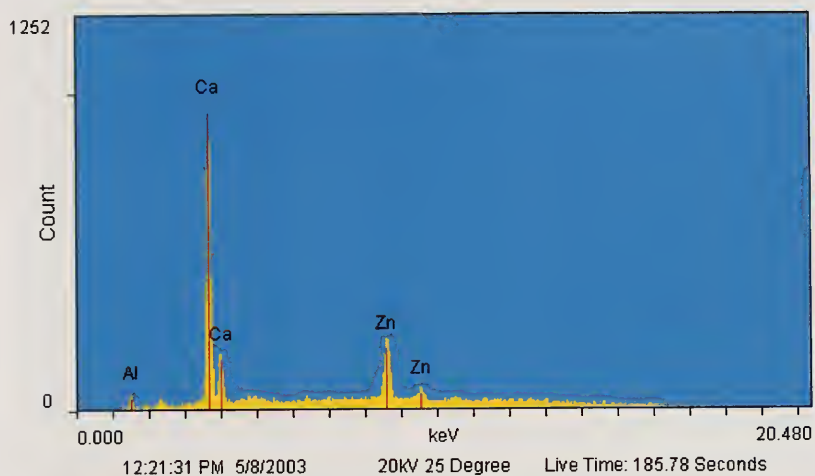


Figure I-4a. Sample 24 first-floor northwest chamber, closet door
cross-section photomicrograph reflected visible light 125X



Figure I-4b. Sample 24 first-floor northwest chamber, closet door
SEM backscatter electron image 56X magnification

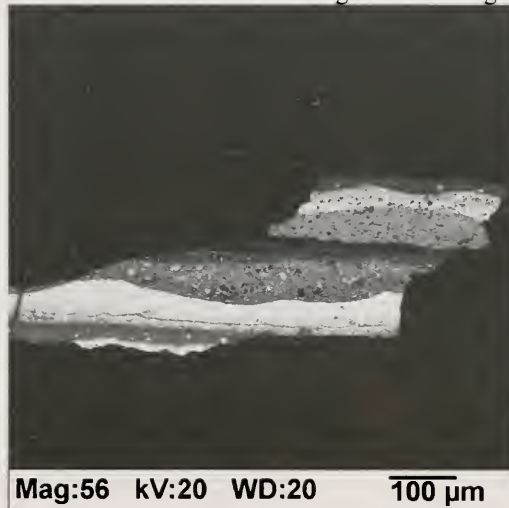


Figure I-4c. Sample 24 first-floor northwest chamber, closet door
SEM-EDS elemental spot analysis, first generation paint

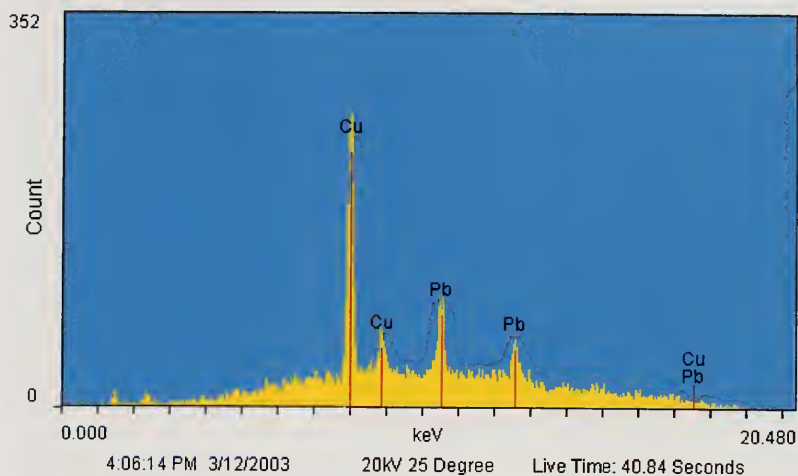


Figure I-5a. Sample 88 first-floor northwest chamber, door architrave
cross-section photomicrograph reflected visible light 125X



Figure I-5b. Sample 88 first-floor northwest chamber, door architrave
SEM backscatter electron image 56X magnification



Figure I-5c.

Sample 88 first-floor northwest chamber, door architrave
SEM backscatter electron image 246X magnification

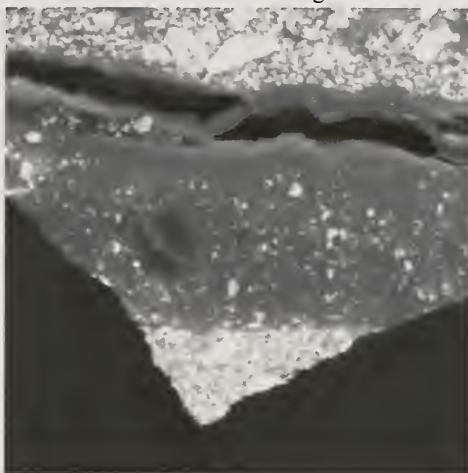


Figure I-5d.

Sample 88 first-floor northwest chamber, door architrave
SEM-EDS elemental mapping 246X magnification
red = lead
green = copper

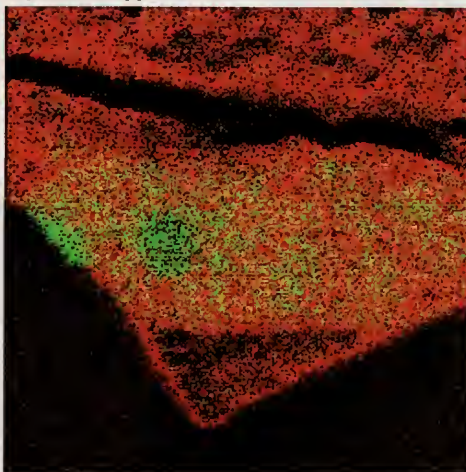


Figure I-6a. Sample 91 drawing room, plaster field
cross-section photomicrograph reflected visible light 125X



Figure I-6b. Sample 91 drawing room, plaster field
SEM backscatter electron image 75X magnification



Mag:75 kV:20 WD:20 100 μ m

APPENDIX J

Figure J-1

Samples 13, 17 and 63
GC chromatogram

File : C:\HPCHEM\1\DATA\LYROLDLN.D
Operator : jhc/ng
Acquired : 18 Jan 2002 16:06 using AcqMethod RTLMFPRX
Instrument : HP6890/59
Sample Name : 1 year old llinseed MethPrep
Misc Info :
Vial Number : 1

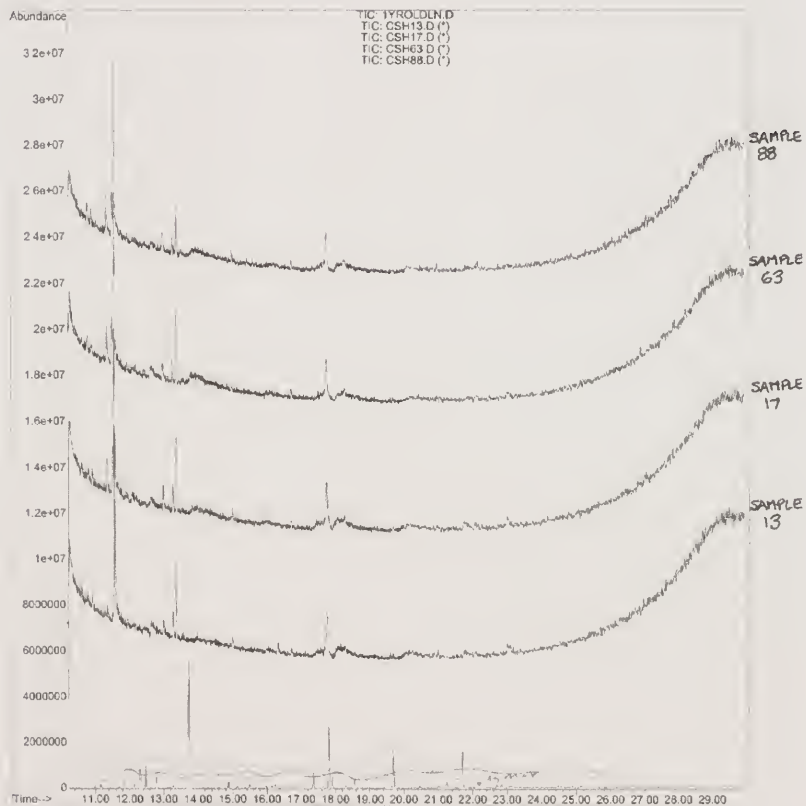
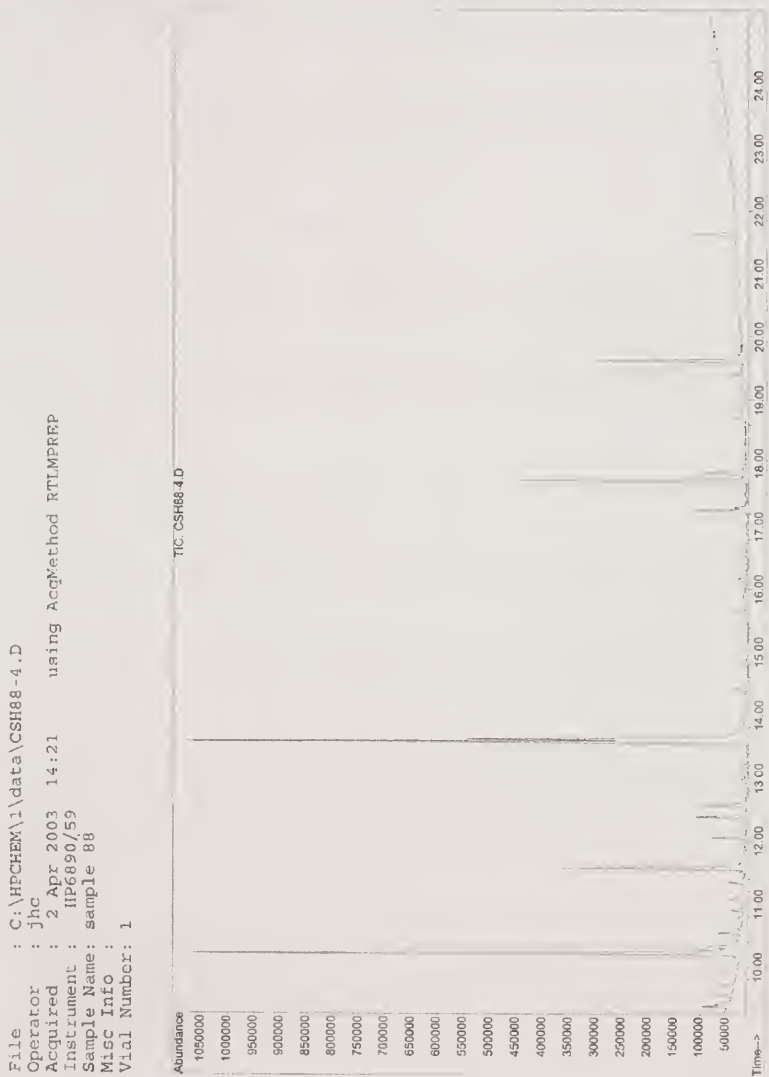


Figure J-2

Sample 88 first-generation, green finish
GC chromatogram



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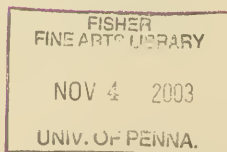
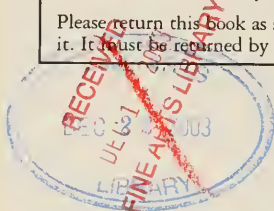
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